

2014-1432

United States Court of Appeals
for the Federal Circuit

INVISTA NORTH AMERICA S.A.R.L. and
AURIGA POLYMERS, INC.,

Plaintiffs-Appellees,

v.

M&G USA CORPORATION and
M&G POLYMERS USA, LLC,

Defendants-Appellants.

*Appeal from the United States District Court for the District of Delaware in
Case No. 1:11-CV-1007-SLR-CJB, Judge Sue L. Robinson.*

**NON-CONFIDENTIAL BRIEF FOR DEFENDANTS-APPELLANTS
M&G USA CORPORATION AND M&G POLYMERS USA, LLC**

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MAY 13, 2014

CERTIFICATE OF INTEREST

Counsel for Defendants–Appellants certifies the following:

1. The full name of every party or amicus represented by me is:

M&G USA Corporation and M&G Polymers USA, LLC.

2. The name of the real party in interest (if the party named in the caption is not the real party in interested) represented by me is:

None.

3. All parent corporations and any publicly held companies that own 10 percent or more of the stock of the party or amicus curiae represented by me are:

M&G Polymers USA, LLC is wholly owned by M&G USA Corporation, which in turn is wholly owned by the privately held Luxembourg company Mossi & Ghisolfi International, S.A., which in turn is wholly owned by the privately held Italian company M&G Finanziaria Srl, which in turn is wholly owned by the privately held Italian company Mossi & Ghisolfi S.p.A. No publicly held corporation owns 10% or more of M&G Polymers USA, LLC or M&G USA Corporation's stock.

4. The names of all law firms and the partners or associates that appeared for the party or amicus now represented by me in the trial court or are expected to appear in this court are:

Thompson Hine, LLP – Megan D. Dortenzo, Frank R. DeSantis, Arthur P. Licygiewicz, Christopher M. Comiskey

Potter Anderson Corroon LLP – Richard L. Horwitz, David E. Moore, Bindu A. Palapura

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CERTIFICATE OF COMPLIANCE

CONFIDENTIAL MATERIAL OMITTED

The material omitted from pages 4, 15, 18, 19, 36 contains M&G's confidential information, including a specific discussion of the technical aspects of the accused product and the composition thereof.

The material omitted from page 15 contains M&G's confidential information, including a specific discussion of M&G customer information.

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LIST OF ABBREVIATIONS

<u>Abbreviation</u>	<u>Meaning</u>
‘159 Patent	U.S. Patent No. 7,919,159 (A223-232))
‘216 Patent	U.S. Patent No. 7,943,216 (A233-242)
‘266 Appl.	PCT Publication No. WO 98/13266. (A14298-4382)
‘578 Appl	Japanese Patent Application No. JP2663578B2 (A14430-34)
‘719 Appl.	European Patent Publication No. 0301719 (A14395-4416)
‘731 Appl.	PCT Publication No. WO 03/080731 (A14277-297)
‘925 Appl.	PCT Publication No. WO 91/17925 (A14218-236)
‘930 Patent	U.S. Patent No. 7,879,930 (A263-268)
Amcor	Amcor Rigid Plastics USA, Inc.
Auriga	Plaintiff-Appellee Auriga Polymers, Inc.
b*	the expression of color denoting the yellow/blue value; higher value = yellow; lower value = blue
BiCo	bi-component resin pellet
Co	chemical symbol for Cobalt
Core Technical Documents	M&G technical specifications related to M&G Products. (A14070-091)
DEG	diethylene glycol

Dr. Moore	M&G's technical expert, Robert B. Moore, Ph.D.
Dr. Turner	Invista's technical expert, S. Richard Turner, Ph.D.
FDA	Food & Drug Administration
Invista	Plaintiffs-Appellees Invista NA and Auriga
Invista-NA	Plaintiff-Appellee Invista North America S.à.r.l.
M&G	Defendants-Appellants M&G Polymers and M&G USA Corporation
MXD6	a type of polyamide or nylon: poly(metaxylylene adipamide)
PET	Polyethylene Terephthalate
PoliProtect	Accused M&G's PoliProtect APB and PoliProtect JB barrier resin products
PolyShield	Invista-NA and Auriga's resin product
ppm	parts per million
SIPA	5-sulfoisophthalic acid
SIPA-based copolyester	a copolyester with SIPA polymerized in the polymer chain - used as an (ionic) compatibilizer

STATEMENT OF RELATED CASES

No other appeal in or from the same civil action or proceeding in the lower court or body was previously before this or any other appellate court.

No other case is known to counsel to be pending in this or any other court that will directly affect or be directly affected by this Court's decision in the pending appeal.

JURISDICTION

The District Court had jurisdiction for the issues presented by Appellants under 28 U.S.C. §1338(a).

The District Court issued its final judgment on April 1, 2014. *See* A163. M&G timely appealed on April 23, 2014. A13085.

This Court has jurisdiction for the issues presented by Appellants pursuant to 28 U.S.C. §1295(a)(1).

I. STATEMENT OF THE ISSUES

- A. Did the District Court err by construing “copolyester comprising a metal sulfonate salt” to include compounds that were clearly disavowed during prosecution?
- B. Were the District Court’s determinations of indirect infringement as a matter of law incorrect because they shifted the burden of proof to M&G?
- C. Was the District Court’s exclusion of testimony and other evidence supporting M&G’s properly raised non-infringement defense reversible error?
- D. Whether the District Court erred by failing to grant summary judgment of invalidity for the ‘216 Patent based on lack of enablement for any metal sulfonate salts other than a specific one made using Na⁺.
- E. Was the District Court’s refusal to grant M&G’s request for JMOL on obviousness legally erroneous?
- F. Did the District Court abuse its discretion by granting a permanent injunction that (1) was not narrowly tailored, (2) included relief on grounds that Invista did not seek, and (3) failed to provide an appropriate transition period?

II. STATEMENT OF THE CASE

Invista filed suit against M&G in October 2011, asserting that M&G's PoliProtect barrier resin product infringed Invista's '216 and '930 Patents. A243. Later, Invista amended its Complaint to assert infringement of the '159 Patent. A271. Auriga, Invista-NA's exclusive licensee, was joined later as an indispensable party. A364.

Invista's '216 Patent relates to a single layer, plastic bottle with improved clarity and barrier qualities (which try to prevent oxygen from entering the bottle). The '216 Patent claims are directed to a plastic composition for containers. The only independent claim is claim 1:

1. A composition for containers comprising:

a copolyester comprising a metal sulfonate salt;

a partially aromatic polyamide;

and a cobalt salt.

A242 (emphasis added).

Throughout fact and expert discovery, M&G consistently confirmed the difference between cobalt salt and cobalt. Invista took the depositions of five M&G employees, or former employees, regarding technical aspects of PoliProtect: Jeff Black, Gianluca Ferrari, Paul Heater, Kevin Rollick, and Steve Ryba. Several of the deponents were asked about the Core Technical Documents (PoliProtect

Confidential Material Redacted

specifications), and each confirmed that cobalt salt was a starting ingredient of PoliProtect. A4831-32 (86:24-87:3); A10630-31 (75:15-76:25); A4823 (213:11-25); A10273 (74:7-77:14); A10521 (34:19-35:8).

In September 2012, M&G supplemented its interrogatory responses regarding non-infringement, stating that M&G's PoliProtect products do not contain the required cobalt salt element. A4572; A4575-92.

In December 2012, Invista's expert, Dr. Turner, provided an expert report stating that PoliProtect infringed the '216 Patent. A4365 (¶20). For cobalt salt, Dr. Turner relied solely on the Material Description section of M&G's Core Technical Documents to prove that cobalt salt is present in PoliProtect. A4390-92 (¶¶92-98). In his report, Dr. Turner relied on the fact that M&G's Core Technical Documents state a "target measurement of [REDACTED] cobalt for the total pellet." A4391 (¶93). M&G had no reason to believe that Dr. Turner was confusing "cobalt salt" for "cobalt" (the metal, Co).

In January 2013, M&G's expert Dr. Moore prepared an expert report stating that PoliProtect does not infringe claim 1 of the '216 Patent. As part of that analysis, Dr. Moore stated: "[s]hortly after the cobalt salt is added, as an Invista report ... establishes, the cobalt salt complexes with the copolyester.... At that time, the cobalt salt as added no longer exists." A4524. Dr. Moore confirmed that

there is no infringement of claim 1 of the ‘216 Patent because cobalt salt does not exist in the final PoliProtect product. A4524.

The District Court’s standard practice combines claim construction and summary judgment proceedings. A335 (8(f)). In its summary judgment motion, and without the District Court’s claim construction, M&G argued that Invista wrongly relied solely on the Material Description section of the Core Technical Documents to prove the existence of cobalt salt in the final accused PoliProtect product. A6061-63; A3282-87; A2187-2208; A14070-91. The PoliProtect specifications – on their face – identify the starting ingredients for PoliProtect, including the amount of cobalt salt needed to achieve a target amount of cobalt (the metal. A2195; A14078; A6061-63.

In April 2013, M&G reaffirmed to the District Court during the combined claim construction and summary judgment hearing that M&G’s Core Technical Documents only described the ingredients of PoliProtect and the material specifications, but not the complete final composition. A7939-40 (101:21-102:24). It had now become apparent that Invista may have a different interpretation of the Core Technical Documents, and that they had incorrectly interpreted “cobalt” to mean “cobalt salt.” Accordingly, M&G supplemented its interrogatory responses in April 2013 to specifically include all of the defenses previously disclosed in Dr.

Moore's report and declaration supporting M&G's reply brief on non-infringement. A4572; A4575-92; A8118-145; A6080-89.

In May 2013, Invista filed a motion to strike what it now claimed was M&G's new defense, as well as the supplemental interrogatory responses and Dr. Moore's related declaration. A8193. Invista claimed that M&G was arguing that the Core Technical Documents do not represent the final PoliProtect product. A8201; A8213. M&G's response confirmed that the Core Technical Documents do represent the PoliProtect product, but the documents must be read in their entirety and the reference to "cobalt" or "Co" in the documents is to the cobalt metal, not to a cobalt salt. A8372-75; A8381.

After briefing their motion, Invista deposed Kevin Rollick, an M&G former employee. Despite knowing M&G's position on the Core Technical Documents, Invista chose not to question Mr. Rollick on the documents or whether it was M&G's practice to test for cobalt metal in PoliProtect. Invista focused its questions solely on the complexation of cobalt salt (*i.e.*, how cobalt salt chemically reacts with the copolyester in the manufacturing process and converts into a new chemical compound).

In June 2013, the District Court entered three orders. The District Court's first order construed the claims. A15, A52. One of the constructions was for the

phrase “copolyester comprising a metal sulfonate salt.” That construction ignored a clear prosecution history disclaimer, and is the first issue raised in this appeal.

The District Court’s second order granted, in part, Invista’s motion to strike. A2; A8193. The District Court struck M&G’s expert’s, Dr. Moore’s, declaration regarding M&G’s Core Technical Documents and related supplemental interrogatory response regarding non-infringement. A2. The District Court held that the Core Technical Documents listed the starting ingredients of PoliProtect. But the District Court also held that Invista was not put on notice that the Core Technical Documents do not contain information on the composition of the final PoliProtect product. A13 (fn. 10). The District Court did this because it was angered at the lack of description in the Core Technical Documents which the District Court requires to be provided early in the case. A7914 (103:4-104:2, 109:19-110:12). However, M&G does not have any further documentation on its final product. As a result, the District Court struck part of Dr. Moore’s declaration and M&G’s supplemental interrogatory responses. A14. The District Court did not strike Dr. Moore’s expert report regarding the complexation of cobalt salt, nor M&G’s ability to discuss the Core Technical Documents in their entirety. A14. A number of subsequent related decisions of the District Court ensued shutting down M&G’s ability to (1) explain its own documents, and (2) present its defense on the

complexation of cobalt salt to cobalt during the polymerization process. The District Court's decision striking this defense is reversible error.

The District Court's third order entered summary judgment that PoliProtect did not directly infringe any asserted claim of the '216 Patent, but indirectly infringed all but one asserted claim (claim 4) of the '216 Patent. A102. The Court's finding of indirect infringement is reversible error.

At the pretrial conference, M&G explained that it intended to use former employee Kevin Rollick as a fact witness. A10257 (18:15-24). Mr. Rollick was on M&G's initial disclosures and was deposed by Invista before trial. M&G intended to call Mr. Rollick to explain the work he performed with PoliProtect while an M&G employee. A10257 (21:10-13). Mr. Rollick was going to testify about the manufacturing of PoliProtect and that cobalt salt complexed immediately after being added in the process. A10257 (21:21-22:14). The District Court precluded Mr. Rollick from testifying at trial, stating: "I don't care what you call him. I think he's an expert. I don't care if you call him a fact witness." A10257 (19:20-21). M&G made a proffer of the factual testimony of Dr. Rollick and seven supporting documents regarding complexation that M&G produced during fact discovery. (A10013-022) The Court rejected M&G's proffer. A112. This exclusion is reversible error.

Right before trial, the parties stipulated to non-infringement of the ‘159 Patent and dismissed it from the case without prejudice. A10349-50. The parties also stipulated to and received a dismissal with prejudice of the ‘930 Patent. A10388. Only the ‘216 Patent went to trial in July 2013 on the issues of invalidity under §103(a) and infringement of claim 4.

During trial, the District Court found M&G’s defense of the Core Technical Documents not disclosing the final composition of PoliProtect not timely raised and precluded evidence on the issue. A13483 (548:25-549:12). The District Court then precluded Kevin Rollick and M&G’s expert, Dr. Moore, from testifying on the complexation of the cobalt salt and that “there is no cobalt salt” in the final composition of M&G’s Products. A13496-500 (pp. 601-617.) The District Court also precluded M&G from presenting the testimony of its employee Steven Ryba regarding the manufacturing process of PoliProtect and the Core Technical Documents, despite M&G’s proffer supporting Mr. Ryba’s anticipated trial testimony with his deposition testimony. A10500-09; A10648-50; A13483-84. The District Court ruled mid-trial that claim 4 was infringed as a matter of law and the jury found the asserted claims not invalid. A13696-97. All of these determinations are reversible error.

In August 2013, M&G renewed its motions for judgment of invalidity and non-infringement as a matter of law, or alternatively, for a new trial. A11079. The

District Court denied both motions. A161. Invista filed a motion for permanent injunction to prevent M&G “from manufacturing, using, offering for sale, or selling in the [U.S.], or importing into” the U.S., PoliProtect until the expiration of ‘216 Patent. A11047. The District Court entered a permanent injunction on March 31, 2014. Final judgment was entered on April 1, 2014. A163. M&G filed its timely Notice of Appeal. A13085.

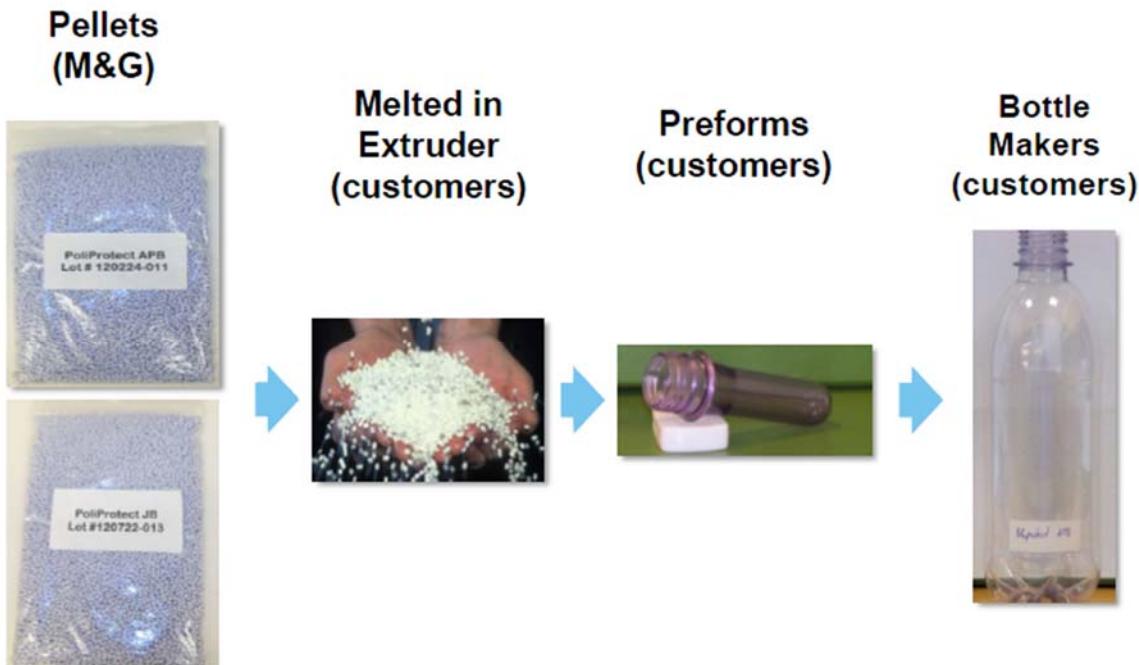
After a teleconference on April 2, 2014 discussing the scope of the injunction and whether it enjoins exports and includes a transition period, Invista filed an E-Mail Request for Emergency Relief with the District Court to issue an injunction order. M&G opposed, in part, because Invista never sought injunctive relief under 35 U.S.C. §271(f). A11047. A161. The District Court entered a permanent injunction against M&G effective May 2, 2014 enjoining the “manufacturing, using, importing, selling, and/or offering to sell in the [U.S.], or exporting from the [U.S.], [PoliProtect]”. A164. M&G filed a request for an emergency stay of the injunction with this Court, but the request was denied. A13252. This Court then ordered expedited briefing. A13252.

III. STATEMENT OF THE FACTS

A. PET and Barrier Technology

This suit relates to polyester, or PET, barrier resins typically used in the food packaging and beverage industries. A4492. PET resin manufacturers, such as

M&G, Invista-NA, and Auriga, manufacture PET pellets, which are sold to bottle converters who melt the pellet and create preforms, which in turn, are formed into bottles and other containers. A4492.

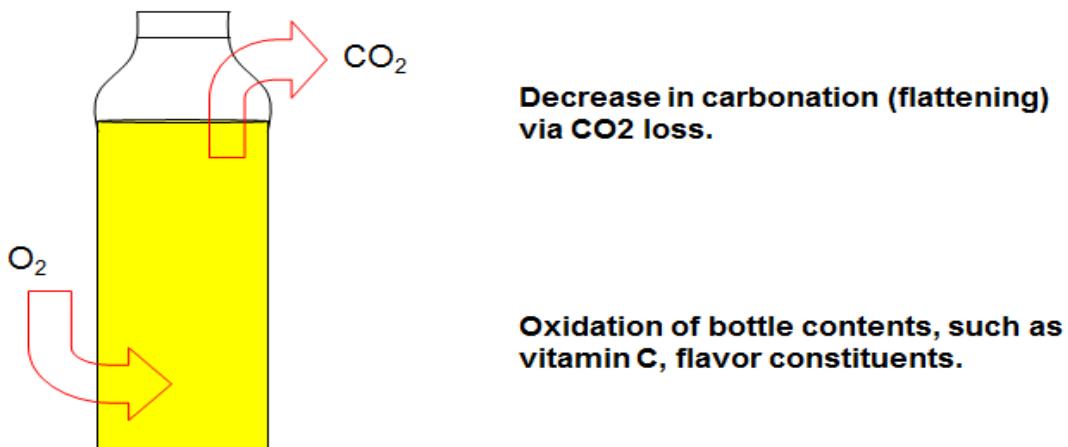


source: Invista's Opening Statement Demonstrative, Trial, July 2013

Often, PET bottles must have certain barrier qualities to prevent or reduce the amount of gas permeating the bottle to protect the contents from contamination and spoilage. A4492. Although many PET resins have sufficient gas barrier properties for most foods and beverages, PET alone does not provide a sufficient gas barrier to prevent unacceptable oxygen contact with foods or juices. A4492.¹

¹ The images are produced in this Brief for illustrative purposes only.

Common Bottle Permeation Problems:



The two main mechanisms for PET bottles to provide barrier protection are passive and active barriers. A4492-94. Passive barriers provide a physical impediment within the bottle wall, increasing the difficulty for oxygen molecules to pass through. A4494. Active barriers provide a chemical impediment within the bottle wall that prevents oxygen ingress by binding with or reacting with oxygen, *i.e.*, scavenging. A4494.

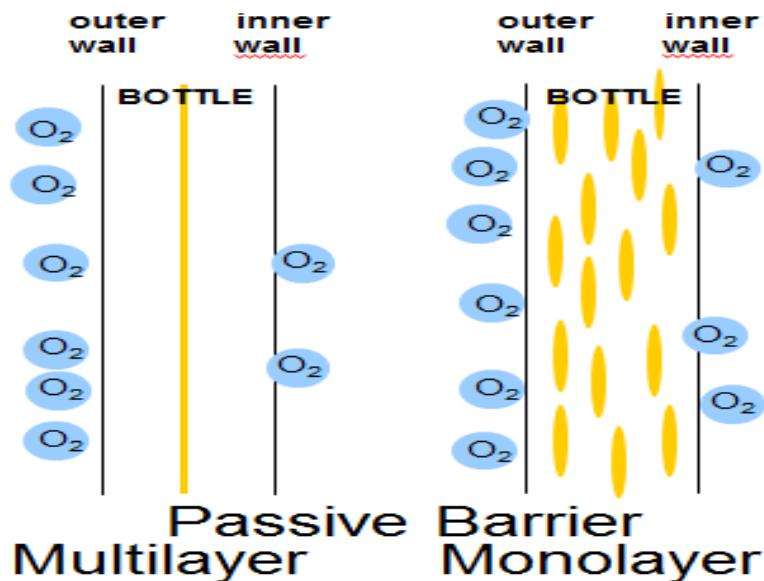
To highlight the appearance of the food or beverage inside, the PET bottles should also be clear and haze free. A4494. When processed properly and oriented into a desired shape, PET can provide a high clarity, low haze bottle.

1. Passive Barrier Solutions (PET w/Nylon)

A passive barrier reduces gas permeability by adding certain strengthening polymers, *e.g.* nylons (or polyamides), to the PET to make gas flow difficult. A4492-93. MXD6, which is a partially aromatic polyamide, is one such nylon.

A4494. Traditionally, a thin layer of MXD6 was placed against a second layer of polyester to form a multi-layer bottle to help block paths of oxygen ingress.

A4493, A236 (1:31-52). Alternatively, MXD6 was blended into the PET and a single or mono-layer bottle was formed. A4493. This was usually done by melting, then mixing, the PET and MXD6, to produce a dispersion of MXD6 (shown in yellow below) in the PET that can be molded into bottles. A4493.

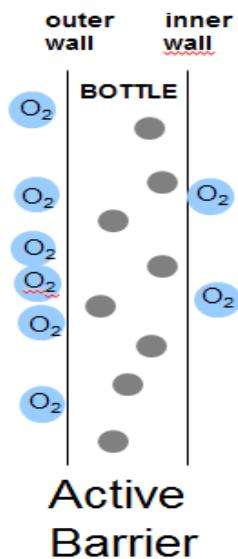


This blend of MXD6 and PET reduces the gas permeability by physically obstructing paths that gas would take through the wall. A4494. The goal is to reduce oxygen permeability to prevent spoiling the bottle contents. A4494. But, the more MXD6 present, the hazier the bottle. A4494. Thus, there is a balance between the amount of MXD6 and haziness. A4494. Ways for reducing the haze, however, are known in the art and can be achieved by various means, including

adding a compatibilizer to increase the uniformity of distribution of MXD6 in the PET. A4494, A3870.

2. Active Barrier Solutions (PET w/Nylon and a Transition Metal)

An active barrier is a chemical composition within a bottle wall that prevents oxygen ingress by binding with or reacting with oxygen. A4494. The active barrier is often referred to as an active scavenger, and has an oxidizable component that reacts with oxygen. A4494. This oxidizable component (shown as gray circles below) is an oxidizable polymer, *e.g.*, MXD6, with a catalyst. A4494. MXD6 can act as both an active and passive barrier. A4494.



The catalyst, which needs to be combined with the oxidizable polymer, is typically a transition metal such as cobalt and enhances the reaction of the MXD6 with oxygen. A4494. MXD6 is significant because it is both a passive barrier and

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an active barrier reactive to oxygen in the presence of the right catalyst. A4494.

Under the right conditions, active barriers in a properly designed bottle keep the amount of oxygen exposed to a beverage at a minimum and increase the shelf life of the product. A4495.

Melt blending is how PET preforms and then bottles are manufactured. A11359 (925:19-24). In active scavenging barriers, it is important to delay the introduction of the catalyst (cobalt) with the oxidizable polymer (nylon) until the bottle is actually made, because as soon as melt blending occurs, the cobalt and nylon begin to scavenge oxygen. A11331. Bottle manufacturers prefer cobalt and nylon to be separate until they make their preforms. A11376 (108:7-113:2). Invista and M&G solve this problem differently. Invista's PolyShield resin does not include nylon (which is sold separately and added by the bottler). M&G's PoliProtect has a patented structure which separates the cobalt and nylon until melt blending occurs. A11331; A13482 (569:19-571:21).

B. M&G and PoliProtect

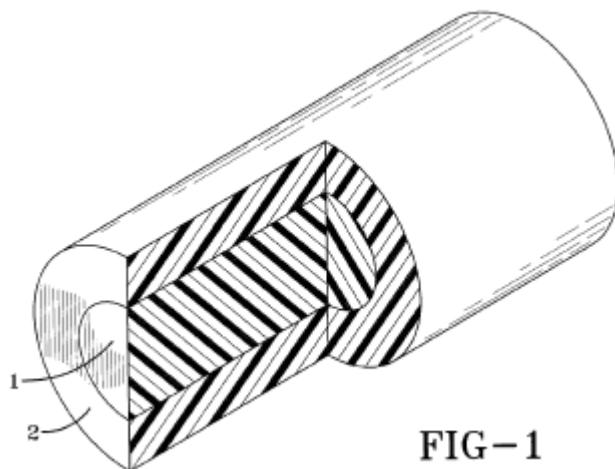
M&G manufactured PoliProtect at one location in the United States (U.S.) - in Apple Grove, West Virginia. M&G served [REDACTED] PoliProtect customers from its West Virginia facility: [REDACTED]
PoliProtect is FDA approved and its customers use PoliProtect to make bottles suitable for food and beverage packaging. A4649, A4647.

PoliProtect resin pellets have a patented multi-layer structure. A11331



source: M&G Photograph of PoliProtect Demonstrative, Trial, July 2013

They are co-extruded into a distinct inner and outer layer - forming a BiCo (bi-component) pellet: A4500.

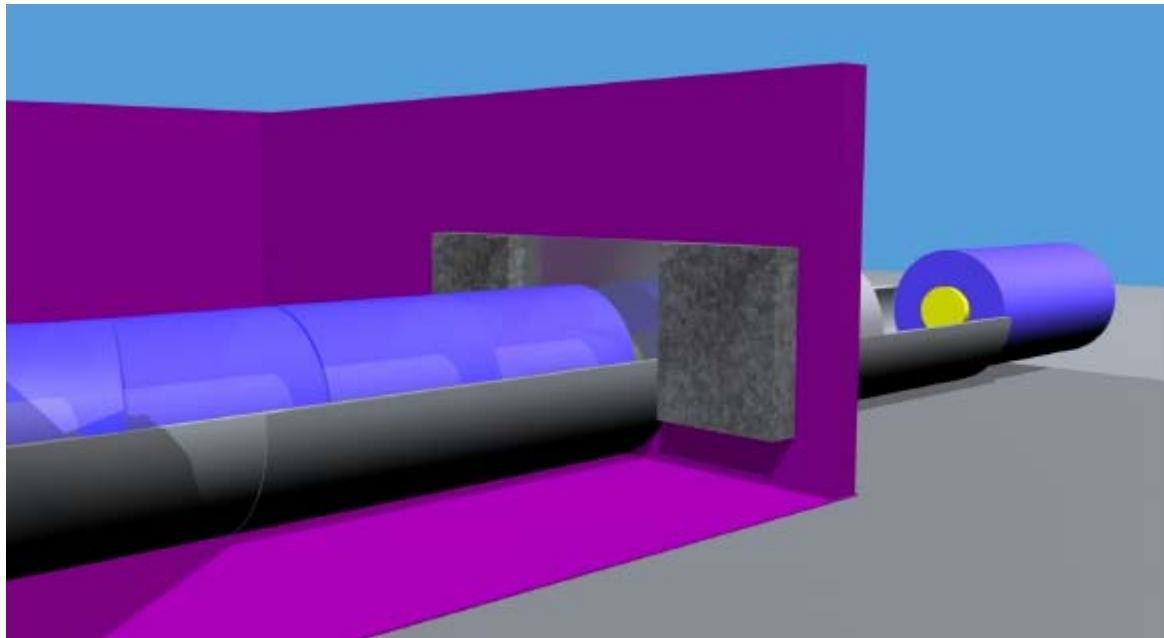


source: M&G U.S. Patent No. 8,436,080

The inner (1) and outer (2) layers of the BiCo pellet are not mixed until melted.

The inner layer is only nylon, MXD6. The outer layer is a SIPA-based copolyester that facilitates for facilitating dispersion of the nylon in the SIPA-based copolyester, with an active barrier catalyst - cobalt metal. A4500.

The manufacturing process makes the copolyester outer layer which is then extruded with the nylon inner layer into the BiCo pellet. Near the end of the manufacturing process of the outer layer, a portion of the copolyester is diverted to an extruder where cobalt salt is added. A6133-34 (56:13-57:24, 59:17-60:4). Upon its introduction, the cobalt salt complexes or chemically reacts with the copolyester. A4524. From that point forward, the cobalt salt no longer exists. A4524. The stream from the cobalt extruder is recombined with the remaining copolyester to form the outer layer of the PoliProtect pellets (purple layer shown below). A6134 (57:1-24, 59:23-60:18).



source: M&G Demonstrative for Fredrick Fournier, Trial, July 2013

Nylon is melted in a second extruder and co-extruded through a special die such that the nylon (yellow) is on the inside, and the outer layer copolyester

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(purple) is on the outside. A6134 (58:23-59:9). The resulting co-extrusion is cooled to a solid, and cut into the resulting BiCo pellets. A6134-35 (60:14-61:4) This novel approach of separating the cobalt in the outer layer and the nylon in the inner layer prevents the start of oxygen scavenging until the PoliProtect BiCo pellets are melted in the bottle manufacturing process.

M&G prepares technical specifications for each manufacturing production run of PoliProtect, and those were produced to Invista as M&G's Core Technical Documents per the District Court's rules. A2187-208, A6061, A14070-91. The specification provides information on the materials and process for manufacturing PoliProtect, and the release specifications of the final product. A14077. M&G does not have any other document or data describing the exact chemical composition of PoliProtect after manufacture. A13455 (536:15-18).

The Material Description of a specification describes the scope of the production run, including the starting ingredients. A14078. For example, one listed component is “██”, with a ████ minimum ppm, ████ maximum ppm, and ████ target ppm of cobalt metal (Co). A14078. The Material Release Specifications identify the target values for certain functional aspects of the released PoliProtect, and the approved test method for calculating each value. For example, the release property “Cobalt, ppm⁶ (Total Pellet)” lists a “Target” amount of ████ cobalt metal and a “Test Method” of

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“ [REDACTED],” A14078, wherein footnote 6 states “[REDACTED]
[REDACTED]
[REDACTED].” A14079.

As shown, cobalt salt (cobalt neodecanoate) is added to the manufacturing process to obtain a target release amount of [REDACTED] ppm of cobalt metal in the final released product. Cobalt salt has a concentration of “[REDACTED]” (cobalt metal), thereby requiring [REDACTED] ppm amount of cobalt salt ([REDACTED]) to be added to achieve the target amount of [REDACTED] ppm cobalt metal in the final PoliProtect product. A14078; A13417; A13454-5 (532:22-533:189); A11180-2.

In this sample, the release specification clearly identifies an amount of cobalt metal, not an amount of cobalt salt in the outer layer of the PoliProtect BiCo pellet, with the approved, standard test method for measuring cobalt metal being [REDACTED]. A13417; A13454-5 (532:22-533:19); A11182-3; A14078-9.

C. Invista And The ‘216 Patent

Invista-NA owns the ‘216 Patent and exclusively licenses it in the U.S. to Auriga. A11060. The ‘216 Patent claims priority to the ‘159 Patent. A236 (1:8-12).

Invista-NA and Auriga do not have a commercial product that embodies any claim of the ‘216 Patent. A11061. Invista has a PolyShield resin, but PolyShield is not a barrier resin, nor an embodiment of the ‘216 Patent, because it does not

have nylon (partially aromatic polyamide). A11061. PolyShield customers purchase nylon separately to add at the start of the bottle manufacturing process if they choose to. A10853 (14:13-18), A11149 (814:14-19); A13576; A13588 (827:3-15). This later addition ensures the delay of oxygen scavenging until the bottles are made. A11331.

Auriga acquired Invista's manufacturing facility in Spartanburg, South Carolina in March 2011, but Auriga has admitted that it cannot make commercial scale quantities of PolyShield. A11280; A13576; A13588 (828:9-14). M&G has no evidence that Auriga has had, or currently has, any U.S. customers for PolyShield. A11384; A11386 (48:2-49:8); A11280; A13576; A13588 (828:9-14). Auriga also admits that once a barrier resin customer uses a particular barrier resin, it would take one year for that customer to transition to a new barrier resin due the custom bottle machines, processes, and logistics to make such a transition. A11265-66. Amcor, a major user of barrier resins for its bottling customers and a PoliProtect customer, confirms that it requires a year to transition to a new barrier resin solution. Doc. 3, Exh. 13.

The '216 Patent discloses the use of a SIPA-based copolyester with a metal sulfonate salt as a compatibilizer for compatibilizing the nylon in the PET. The '216 Patent discloses that the metal ion of the metal sulfonate salt may be "sodium, lithium, potassium, zinc, manganese, calcium, and the like." A237 (4:64-67).

However, only sodium and zinc metal ions were used in the test runs and examples of the patent. A240-41 (10:60-11:8). And, only sodium metal ions were used in test runs supporting Invista's argument of "unexpected results" to overcome obviousness rejections in both the '159 and '216 Patents.

IV. SUMMARY OF ARGUMENT

This appeal relates to Invista-NA's '216 Patent. Appellant M&G was found not to directly infringe any claim of the '216 Patent at the District Court, but was found to indirectly infringe these claims of that same patent. This appeal relates to five fundamental errors made by the District Court:

- 1.** Misconstruing a critical claim term;
- 2.** Granting summary judgment of indirect infringement;

Granting judgment as a matter of law of indirect infringement; and

Granting summary judgment of no invalidity;

Granting a permanent injunction, or at least not providing an appropriate transition period in doing so.

M&G respectfully requests that this Court reverse the District Court and remand.

The District Court's first error was misconstruing a critical term of the '216 Patent. Regarding the term "copolyester comprising a metal sulfonate salt," Invista-NA expressly disavowed to the PTO the broad construction entered by the District Court.

Second, the District Court erred by granting summary judgment of indirect infringement. Invista's expert never performed the necessary infringement analysis of PoliProtect. All but one of the asserted claims of the '216 Patent are composition claims dependent from claim 1,² with the remaining dependent claim³ being directed to a preform or container having the composition of claim 1. An infringing composition must contain all elements of claim 1, including cobalt salt. M&G's admits that the accused product, PoliProtect, uses cobalt salt as an ingredient as part of the manufacturing process, but that during the manufacturing process the cobalt salt is chemically complexed such that it does not exist in PoliProtect. PoliProtect contains only cobalt metal ions, which are remarkably different from cobalt salt. Further, at the time the cobalt salt is added in the manufacturing, there is no partially aromatic polyamide (or nylon). At no time during the manufacturing or use of PoliProtect are all claim elements of claim 1 of the '216 Patent present.

Both Invista's expert (Dr. Turner) and the District Court relied on M&G's Core Technical Documents for their infringement analysis, which identified the ingredients used to make PoliProtect, but not the composition of the resulting PoliProtect product. Invista's expert admitted to not testing PoliProtect for cobalt salt. Without adequate proof of infringement, the District Court erred by granting

² Asserted claims 1-5, 8-9.

³ Asserted claim 12.

summary judgment, as well as judgment as a matter of law, of indirect infringement.

Third, the District Court erred by ruling that the ‘216 Patent was not invalid under §112. Once the District Court construed the claims as broadly as it did, the claims were no longer enabled. Despite this fact, the District Court granted summary judgment finding the claims were enabled.

Fourth, the District Court erred by granting the ‘216 Patent was not invalid for obviousness under §103(a). While M&G presented evidence that a person of ordinary skill in the art (POSITA) would combine an active barrier solution with a passive barrier solution to arrive at the claimed invention, the District Court erred in ruling that Dr. Moore did not testify as to the motivation to combine prior art references. The prior art discloses the motivation to combine, providing the basis for the District Court’s error in holding the ‘216 Patent not invalid.

Fifth, the District Court erred on the grant and timing of a permanent injunction for at least three reasons. First, it relied on inaccurate facts in granting the permanent injunction and thus its irreparable harm determination is flawed. Second, it failed to properly weigh the public interest factors in granting the permanent injunction. Third, when it granted the permanent injunction, the District Court instituted the injunction with a mere 10 days’ notice.

V. ARGUMENT

A. Standards of Review

This Court reviews claim construction *de novo*. *Lighting Ballast Control LLC v. Philips Elecs. N. Am. Corp.*, 744 F.3d 1272, 1276–77 (Fed. Cir. 2014)(*en banc*).

Grant of summary judgment is reviewed *de novo*. *Elekta Instrument Int'l, Inc.*, 214 F.3d 1302, 1306 (Fed. Cir. 2000). “Summary judgment is appropriate if there is no genuine issue of material fact and the moving party is entitled to judgment as a matter of law. In making this determination, [the Court] must consider the evidence in the record in the light most favorable to the nonmoving party.” *Smith v. City of Allentown*, 589 F.3d 684, 689 (3d Cir. 2009)(citations and internal quotations omitted).

A grant or denial of a judgment as a matter of law (JMOL) is reviewed *de novo*. *See Markman v. Westview Instruments, Inc.*, 52 F.3d 967, 975 (Fed. Cir. 1995); *NobelpharmaAB v. Implant Innovations, Inc.*, 141 F.3d 1059, 1064 (Fed. Cir. 1998). This Court exercises plenary review over the grant of JMOL by the District Court, applying the same standard that the lower court should have applied. *See DePuy Spine, Inc. v. Medtronic Sofamor Danek, Inc.*, 469 F.3d 1005, 1013 (Fed. Cir. 2006) (citation omitted); *Farrell v. Planters Lifesavers Co.*, 206 F.3d 271, 278 (3d Cir. 2000). JMOL should be granted when the jury’s findings are not supported by substantial evidence or, if they were, that the legal

conclusions implied by the jury's verdict cannot in law be supported by those findings. *Pannu v. Iolab Corp.*, 155 F.3d 1344, 1348 (Fed. Cir. 1998).

Decisions affecting admissibility of evidence are reviewed under the law of the regional circuit. *Ethicon, Inc. v. U.S. Surgical Corp.*, 135 F.3d 1456, 1465 (Fed. Cir. 1998). The Third Circuit reviews a ruling on admissibility of evidence for abuse of discretion. *In re Paoli R.R. Yard PCB Litig.*, 35 F.3d 717, 749 (3d Cir. 1994). But, if the ruling turns on an interpretation of a Federal Rule of Evidence, this Court's review is plenary. *DeLuca v. Merrell Dow Pharm.*, 911 F.2d 941, 944 (3d Cir. 1990); *U.S. v. Furst*, 886 F.2d 558, 571 (3d Cir. 1989) ("To the extent that the district court's admission of these documents was based on an interpretation of the Federal Rules of Evidence, we exercise plenary review, . . . but to the extent that the district court was making a discretionary ruling premised on a permissible view of the law we may review the ruling only for an abuse of discretion.").

A jury's conclusions on obviousness are reviewed without deference, while the underlying factual findings, whether explicit or implicit within the verdict, are reviewed for substantial evidence. *Johns Hopkins Univ. v. Datascope Corp.*, 543 F.3d 1342, 1345 (Fed. Cir. 2008). A "substantial evidence review involves an examination of the record as a whole, taking into consideration evidence that both justifies and detracts from the decision of the fact-finder." *SIBIA Neurosciences, Inc. v. Cadus Pharm. Corp.*, 225 F.3d 1349, 1354-55 (Fed. Cir. 2000). Even if the

underlying findings are upheld, the court must separately “ensure that the law has been correctly applied to the facts.” *Agrizap, Inc. v. Woodstream Corp.*, 520 F.3d 1337, 1343 (Fed. Cir. 2008).

A court’s “decision to grant or deny permanent injunctive relief, an act of equitable discretion by the district court, [is] reviewable on appeal for abuse of discretion.” *eBay Inc. v. MercExchange, L.L.C.*, 547 U.S. 388, 391 (2006). Abuse of discretion may be found “on a showing that the court made a clear error of judgment in weighing relevant factors or exercised its discretion based upon an error of law or clearly erroneous factual findings.” *Innogenetics, N.V. v. Abbott Labs.*, 512 F.3d 1363, 1379 (Fed. Cir. 2008) (internal quotations omitted). To the extent a court’s decision is based upon an issue of law, [the Court] reviews that issue de novo.” *Sanofi-Synthelabo v. Apotex, Inc.*, 470 F.3d 1368, 1374 (Fed. Cir. 2006).

B. The Court Erred In Construing The Term “Copolyester Comprising a Metal Sulfonate Salt”⁴

Under a proper construction of the term “copolyester comprising a metal sulfonate salt,” M&G’s PoliProtect product does not infringe. But the District Court wrongly construed the phrase “copolyester comprising a metal sulfonate salt” as “a copolyester including, but not limited to, a metal sulfonate salt.” A32-37. (emphasis added.) This incorrect construction includes compositions where the copolyester is attached to a metal sulfonate salt even though this arrangement was disavowed during prosecution. A2370. The term instead should be construed as “a copolyester including a metal sulfonate salt, wherein the metal sulfonate salt is not attached to the copolyester.”

When originally filed, the predecessor to claim 1 of the ‘216 Patent included this limitation as: “a copolyester containing a metal sulfonate salt”. A2301 (emphasis added). The Examiner rejected this claim as indefinite under 35 U.S.C. §112 because “it is unclear as to whether or not the metal sulfonate salt is attached

⁴ Invista announced plans to argue “[a]s an alternative ground for affirmance,” . . . “that the district court incorrectly construed one claim term that led to the district court granting summary judgment of no direct infringement.” (Doc. 32; Doc. 33). Invista is not permitted to sidestep a failure to timely file a cross appeal merely by prefacing it as “[a]s an alternative ground for affirmance,” because the granting of summary judgment of no direct infringement is not an issue ripe for appeal and may not be modified. *See, Carnival Cruise Lines, Inc. v. United States*, 200 F.3d 1361, 1365 (Fed. Cir. 1994) (quoting *Trans World Airlines, Inc. v. Thurston*, 469 U.S. 111, 119 n.14 (1985) (“An argument that would modify the judgment . . . cannot be presented unless a cross-petition has been filed.”)).

to the copolyester.” A2347. The Examiner also rejected this claim as obvious over the prior art under 35 U.S.C. §103(a). A2348. In direct response to the Examiner’s rejections, Invista-NA submitted evidence of what it claimed to be “unexpected results” and amended the claim to read “a copolyester comprising a metal sulfonate salt,” simply replacing “containing” with “comprising.” A2365 (emphasis added). Invista-NA then stated:

Regarding Claim 31 [issued claim 1], Applicant has amended Claim 31 to clarify that the copolyester comprises the metal sulfonate salt, which should negate any confusion as to whether or not the metal sulfonate salt is attached. For the record, the metal sulfonate salt is **not attached** to the copolyester.

A2370 (emphasis added). This statement is a clear and unmistakable prosecution history disclaimer. Invista disavowed compositions where the metal sulfonate salt is attached to the copolyester. *Brogen Idec, Inc. v. Glaxosmith Kline, LLC*, 713 F.3d 1090, 1095 (Fed. Cir. 2013)). Thus, a “copolyester comprising a metal sulfonate salt” (as issued) and “copolyester containing a metal sulfonate salt” (as filed) cannot mean the same thing. *Southwall Technologies, Inc. v. Cardinal IG Co.*, 54 F.3d 1570, 1576 (Fed. Cir. 1995) (“Claims may not be construed one way in order to obtain their allowance and in a different way against accused infringers.”); *Festo Corp. v. Shoketsu Kinzoku Kogyo Kabushiki Co., Ltd.*, 535 U.S. 722, 733-734 (2002).

Accordingly, a “copolyester comprising a metal sulfonate salt” should be construed as “a copolyester including a metal sulfonate salt wherein the metal sulfonate salt is not attached to the copolyester.”

C. The District Court Erred by Determining Indirect Infringement of the ‘216 Patent as a Matter of Law

The District Court further erred by finding indirect infringement as a matter of law. The District Court first granted summary judgment that PoliProtect indirectly infringed all but one asserted claim of the ‘216 Patent, and later ruled, as a matter of law, in the middle of trial that PoliProtect indirectly infringed claim 4 of the ‘216 Patent. A84; A13691, (1104:23-24). Both of these rulings were made in spite of contrary facts that should have been taken in M&G’s favor. *Reeves v. Sanderson Plumbing Prods.*, 530 U.S. 133, 150-151 (2000).

Specifically, the District Court interpreted M&G’s Core Technical Documents that described the *ingredients* used in making PoliProtect as disclosing the chemical *composition* of the final product itself. (Ryba, A10521 (34:19-35:14); A10526-27 (56:18-25); A10533-34 (85:11-17); A10544-45 (128:13-129:8)) (Ferarri, 30(b)(1) A10630-31 (75:15-76:25)). The District Court also reversed the burden of proving the presence of cobalt salt in PoliProtect from Invista, the patent owner, to M&G, the accused infringer. A79-81. Finally, the District Court precluded M&G from presenting testimony at trial as to these facts. A13440

(476:19-23). The District Court thus erred as a matter of law, and M&G respectfully requests that this Court reverse these errors.

1. The District Court Improperly Shifted the Burden of Proof from Invista to M&G

Invista has the burden of proving infringement; it is not M&G's burden to prove non-infringement. *Cephalon, Inc. v. Watson Pharms.*, 707 F.3d 1330, 1340 (Fed. Cir. 2013). In trying to make its infringement proof, Invista chose not to determine the contents of PoliProtect. A7163-64. Instead, Invista took the starting ingredients from M&G's Core Technical Documents and asked the District Court to assume the final PoliProtect product contained the claimed cobalt salt. A7107-09; A7120-22.

a. Invista never proved there is cobalt salt in the finished PoliProtect product.

It is PoliProtect itself, not the manufacturing specifications, that must be compared to the claims to determine infringement. *Rosby Corp. v. Stoughton Trailers, Inc.*, No. 95 C 0511, 2003 WL 22232802, *3 (N.D.Ill. September 26, 2003) ("It the accused product, not the manufacturing specifications that is compared to the claims in determining infringement.") (citing *Johnson & Johnston Assocs. Inc. v. R.E. Serv. Co.*, 285 F.3d 1046, 1052 (Fed. Cir. 2002)). Invista's expert Dr. Turner admitted that no testing or experimental work was ever performed on PoliProtect. A6142 (86:19-87:15); A6149 (123:17-124:5). Dr. Turner even admitted that he had never seen or touched the accused PoliProtect.

A6141 (79:24-80:16). Invista's only evidence of a cobalt salt in PoliProtect is Dr. Turner's conclusory testimony that the final product must contain all of the ingredients listed in the manufacturing process. A6142 (85:1-86:17).

When mixing chemicals, chemical reactions can occur and chemical compounds often change form. M&G's expert, Dr. Moore, described this phenomenon in the context of this case in his expert report. A4524. Dr. Moore explained that the cobalt salt used to make PoliProtect complexes during manufacturing such that it no longer exists in the final product. A4524. During deposition, Dr. Moore testified that because he did not test the final PoliProtect product for cobalt salt, he refused to speculate about it. A6164 (129:22-130:15).

Despite this testimony, Invista's expert did not offer any explanation or discussion of cobalt salt, its complexation, or the related chemical reactions. A4358-4483. Instead, Dr. Turner only made the general observation – cobalt salt in, cobalt salt out. *Id.* Dr. Turner's conclusory testimony ignores (i) M&G's and Invista's personnel testifying that the "cobalt" term recited in data sheets refers to only the amount of cobalt metal, and not the amount of cobalt salt; and (ii) Invista's internal documents which confirmed that complexation occurs in the polymerization process. A10521 (34:19-35:14); A10526-27 (56:18-25); A10533-34 (85:11-17); A10544-45 (128:13-129:8). Invista did not present, and indeed

does not have, any data to show if any cobalt salt remains in the final PoliProtect product after complexation occurs.

Thus, M&G raised a material issue of fact as to the final composition of the accused PoliProtect that was not rebutted by Invista.

b. The District Court improperly evaluated the credibility of the expert witnesses on summary judgment.

The District Court granted summary judgment of indirect infringement *despite* the conflicting opinions of M&G’s and Invista’s experts. In its Summary Judgment Order, the District Court gave Invista a ‘pass’ for not actually proving that each of the elements of the claims were present in the final product. A79-81. Instead, the District Court weighed the credibility of the experts and discounted the testimony of Dr. Moore, M&G’s expert, stating that not testing PoliProtect indicated that “M&G has no evidence that could lead a reasonable jury to conclude that there is not at least some trace amount of cobalt salt left in the final [M&G Products], even if some complexes.” A80.

In doing so, the District Court exposed the flaw in its reasoning – Invista’s expert had performed no testing either. A6141 (79:24-80:16), A6142 (86:19-87:15), A6149 (123:17-124:5). Thus, the District Court based its summary judgment decision on weighing the credibility of the respective experts, which is not appropriate for summary judgment. *The Charles Machine Works, Inc. v. Vermeer Mfg. Co.*, 723 F.3d 1376, 1380-81 (Fed. Cir. 2013); *Freeland v. Enodis Corp.*, 540 F.3d 721, 737-38 (7th Cir. 2008) (reversing district court’s grant of

summary judgment because expert “credibility determinations are not a matter for summary judgment.”) (emphasis added). In light of the conflicting expert testimony and Invista’s failure to analyze, much less prove, the actual contents of PoliProtect, the District Court’s grant of summary judgment was improper. M&G respectfully requests that the District Court’s grant of summary judgment of indirect infringement be reversed.

2. M&G Was Prejudiced by the Exclusion of Related Testimony and Support.

The District Court made several errors in precluding M&G from discussing or making arguments regarding its own Core Technical Documents. *Quinn v. Consol. Freightways Corp of Del.*, 283 F.3d 572, 577 (3d Cir. 2002) (district court abused its discretion in excluding critical evidence where there was no indication that the plaintiff acted in bad faith); *id.* at 578 (“To exclude critical evidence for failing to amend interrogatory answers under these circumstances champions form over substance and denied Quinn her full day in court.”) (citing *Lockhart v. Westinghouse Credit Corp.*, 879 F.2d 43, 53 (3d Cir. 1989) (It is “highly probable that the evidentiary rulings affected the outcome of the case.”)).⁵ First, the District

⁵ *Eli Lilly & Co. v. Actavis Elizabeth LLC*, 2010 U.S. Dist. LEXIS 44913, at *15-16 (D.N.J. May 7, 2010) (applied in patent context, finding that the prejudice to the defendant was “genuine, but curable”); *Newman v. GHS Osteopathic Inc.*, 60 F.3d 153, 156 (3d Cir. 1995) (“[T]he district court may be found to have abused its discretion if [its] exclusion of testimony results in fundamental unfairness in the trial of the case.”) (quoting *Orjias v. Stevenson*, 31 F.3d 995, 1005 (10th Cir. 1994), *cert. denied*, 513 U.S. 1000 (1994).)

Court improperly struck (1) parts of Dr. Moore's declaration which provided support of M&G's Summary Judgment Motion on Non-Infringement, A6086-87 (¶13), and (2) M&G's supplemental interrogatory responses filed April 29, 2013. A14.

The District Court compounded this error by precluding M&G from presenting any evidence at trial regarding the scope and nature of M&G's own Core Technical Documents, which included precluding current and former employees, Steven Ryba and Kevin Rollick, from testifying. A13483 (548:8-552:7). In addition, the District Court held during trial that M&G's only defense to-date regarding non-infringement was claim construction, and as such, M&G was precluded from arguing the fact-based defense of whether cobalt salt existed in PoliProtect. A13483 (548:20-549:12).

The District Court erred in these rulings, which were highly prejudicial to M&G. The District Court's ruling prevented M&G from presenting facts regarding the underlying chemistry of cobalt salt and cobalt metal based on its own Core Technical Documents, Dr. Moore's expert report, and M&G's summary judgment briefing. *Quinn v. Consol. Freightways Corp of Del.*, 283 F.3d at 577; *Eli Lilly & Co. v. Actavis Elizabeth LLC*, 2010 U.S. Dist. LEXIS 44913 at 15-16 (D.N.J. May 7, 2010) (applied in patent context); *Newman v. GHS Osteopathic Inc.*, 60 F.3d 153, 156 (3d Cir. 1995) ("the district court may be found to have abused its discretion if [its] exclusion of testimony results in fundamental

unfairness in the trial of the case.”) (quoting *Orjas v. Stevenson*, 31 F.3d 995, 1005 (10th Cir.), *cert. denied*, 513 U.S. 1000 (1994)). M&G respectfully requests that the District Court’s exclusion of this evidence be found improper.

3. M&G Confirmed that the Core Technical Documents Are Accurate and Reflect the Pre-Manufacturing Composition of PoliProtect.

In its rulings, the District Court suggests that M&G was disingenuous in originally stating that its non-infringement defense was based only on claim construction. A13 The District Court suggested that M&G raised an issue about the nature and content of the Core Technical Documents at the last minute, and that those documents do not accurately reflect the composition of PoliProtect. A13-14 (¶13), A13454 (530:2-9), A13456 (538:10-539:8), A13483 (548:8-549:12). The District Court is wrong. M&G previously explained that the Core Technical Documents are accurate and reflect the pre-manufacturing composition of PoliProtect and certain release specifications of the final PoliProtect product. A7939-40 (101:21-105:4) The District Court’s error is assuming that the starting ingredients of a chemical product must be in the composition of the final product, but that is not true. The starting ingredients of a resin product are not necessarily present in the final product in their original form.⁶ Until the District Court’s

⁶ As an example, baking soda (or sodium bicarbonate) is an ingredient in making cookies, but the final cookie does not actually contain baking soda in its original chemical form. The baking soda is converted to carbon dioxide during the manufacturing process. Cobalt salt in PoliProtect converts in a similar manner.

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rulings, M&G had no understanding that “cobalt” by itself may have been actually considered to be “cobalt salt,” due in part to the language on the Core Technical Documents.

4. The Core Technical Documents Identify The Amount of Cobalt Metal That Is Found In The Final PoliProtect Product.

As explained above, the Core Technical Documents identify that cobalt (*i.e.*, the cobalt metal, “Co”) is added during manufacturing of the resin in the form of cobalt neodecanoate (a cobalt salt). A14078; *see also* A11179-184. The fact that cobalt metal is measured in the final product is further evidenced in footnote 6 of the Core Technical Documents which states that [REDACTED] ppm of “Co” is in the outer shell of the BiCo PoliProtect pellet. A14079 (fn. 6). Nowhere on the Core Technical Documents is there a data point identifying an amount of cobalt salt in the final PoliProtect product. A14070-091.

5. M&G Timely Raised Its Cobalt Salt Argument.

M&G properly put Invista on notice of M&G’s defense regarding the topic of cobalt complexation and whether cobalt exists in PoliProtect as a cobalt salt or the cobalt metal. At least as early as August 2012, M&G raised this fact-based defense during deposition discovery. *Eli Lilly & Co. v. Actavis Elizabeth LLC*, 2010 U.S. Dist. LEXIS 44913 at *12 (D.N.J. 2010) (citations omitted) (“A majority of courts, the leading treatises, and the Advisory Committee Note to Rule 26 agree that an individual’s existence or knowledge can ‘otherwise be made

known,’ and thus be sufficiently disclosed for Rule 26 purposes, through deposition testimony.”). Beginning in August 2012, M&G put Invista on notice of the cobalt salt versus cobalt metal issue during the deposition testimony of M&G’s current and former employees: Mr. Steve Ryba (deposed Aug. 14, 2012; A10521 (34:19-35:14); A10526-27 (56:18-25); A10533-34 (85:11-17); A10544-45 (128:13-129:8)), Mr. Paul Heater (deposed Sept. 5, 2012; A4823 (213:11-25)), Mr. Jeff Black (deposed Sept. 28, 2012; A4831-32 (86:24-87:3)), Mr. Gianluca Ferrari (deposed Sept. 7, 2012; A10630-31 (75:15-76:25)); and Kevin Rollick (deposed May 29, 2013; A10272-74 (74:7-77:14)). Invista’s own employee, Karsten Fritsch, even acknowledged the difference regarding the use of cobalt salt as a starting ingredient for adding a specific amount of cobalt metal, and measuring the amount of cobalt metal. (deposed Aug. 9, 2012; A10539-540 (108:1-110:25)).

In his January 2013 expert report on non-infringement, Dr. Moore discussed the complexation of cobalt salt during polymerization. Dr. Moore explained the scientific theory of salt complexation as it would apply to the M&G polymerization process. A4524. He cited an Invista report to support his opinion that when a salt undergoes complexation its constituents convert into another form, such that “the cobalt salt as added no longer exists.”⁷ A4524. *See Guidance*

⁷ M&G also raised this defense in its Motion for Summary Judgment on Non-Infringement (DI 266). *See Tritek Techs., Inc. v. United States*, 63 Fed. Cl. 740, 748-49 (Fed. Cl. 2005) (“Nothing in the text or underlying purpose of the rule suggests that arguments presented in the Original MSJ cannot be used to provide sufficient notice.”).

Endodontics, LLC v. Dentsply Int'l, Inc., 2010 U.S. Dist. LEXIS 98631 at 94-95 (D.N.M. 2010) (finding that a disclosure in an expert report is sufficient to otherwise make information known to other parties under Fed. R. Civ. P. 26(e)). M&G then presented its cobalt complexation argument using its Core Technical Documents to the District Court during claim construction and summary judgment. A199. Following that hearing, Invista took the deposition of Kevin Rollick and discussed the complexation of cobalt salt in detail, but chose not to question Mr. Rollick on the Core Technical Documents. *See, e.g.*, A10265-280.

6. The District Court Erred in Its Indirect Infringement Ruling.

Accordingly, the District Court erred as a matter of law in (1) finding that PoliProtect indirectly infringed all but one asserted claim at summary judgment, (2) precluding M&G from introducing evidence at trial as to the non-infringement of claim 4 of the '216 Patent, and (3) ultimately taking the issue from the jury by ruling as a matter of law that M&G indirectly infringed claim 4. The District Court's Orders should be vacated, its rulings on excluding testimony and other evidence should be reversed, and a new trial should be granted. *See e.g. Choice Hotels Int'l v. Goodwin & Boone*, 11 F.3d 469, 471 (4th Cir. 1993) ("[W]e have long adhered to the sound public policy of deciding cases on their merits, and not depriving . . . parties of [their] fair day in court." (internal quotations and citations omitted)). The excluded evidence from M&G witnesses would directly impact the

outcome of the case, and should have been allowed in the interest of fairness and justice. *Outside the Box Innovations, LLC v. Travel Caddy, Inc.*, 695 F.3d 1285, 1297-99 (Fed. Cir. 2012) (remanding for redetermination of obviousness, on the entirety of the evidence, including precluded expert testimony).

D. Whether The Court's Grant Of JMOL As To Infringement Of Claim 4 Of The '216 Patent Should Be Reversed Because The Court Erred When It Permitted Invista's Expert To Provide Testimony At Trial Regarding FDA Documents And Cobalt Amounts When This Was Not Disclosed By The Expert Before Trial.

At trial, Dr. Turner gave testimony that the Core Technical Documents show that PoliProtect has the claimed amount of cobalt salt necessary for infringement of claim 4 of the '216 Patent. A13432 (445:8-13). Immediately following that testimony, counsel for Invista asked Dr. Turner if he had any more documents that support that opinion of infringement of claim 4 and he replied, “[y]es. There were some FDA reported concentrations also.” A13432 (445:14-16). When asked more directly whether he considered “M&G’s submissions to the FDA and what they told the FDA in reaching [his] opinion [as to infringement of claim 4],” Dr. Turner replied, “[a]bsolutely.” A13432 (445:17-20). Trial was the first time that Dr. Turner espoused this theory.

In preparing his expert report on infringement, Dr. Turner did not rely on any FDA documents to support his opinion regarding the amount of cobalt salt in PoliProtect and infringement of claim 4. A4390-91 (¶¶92-94), A4398-99 (¶¶114-

17), A4455-56 (¶¶357-363). The only reference to FDA documents and its relation to cobalt in Dr. Turner's expert report was to the general nature of cobalt being a transition metal and that it was used in making PoliProtect:

Cobalt is a transition metal, in that cobalt is a metal in the fourth row of the Periodic Table. M&G generally identified cobalt salts to the FDA for use in its PoliProtect products.

A4391 (¶94), A4399 (¶117). It does not state that cobalt salt is in the final composition of PoliProtect.

It is clear from this statement that Dr. Turner in no way relied upon the FDA documents to support his opinion regarding infringement of claim 4. As such, Dr. Turner's testimony that the FDA documents supported his infringement opinion was beyond the scope of his expert report and came as a complete surprise to M&G. M&G made a timely objection to this testimony by Dr. Turner, as required under the rules of the District Court. A13433 (446:20-447:2). Yet, even though Dr. Turner's trial testimony should have been stricken and not considered by the District Court, it enabled the District Court to grant judgment of a matter of law on infringement of claim 4, without giving M&G an opportunity to respond. At a minimum, the issue of infringement should have been sent to a jury, who then could weigh the testimony of Invista's and M&G's witnesses.

E. The District Court Erred By Failing To Grant Summary Judgment Of Invalidity Based On Lack Of Enablement For The Full Claim Scope Of All Metal Sulfonate Salts

The District Court refused to consider M&G’s arguments to limit construction of the metal sulfonate salt to only the salt (Na⁺) that purportedly achieves “unexpected” results. Instead, the Court advised that “such an argument is more appropriately raised as a theory of invalidity.” A43-44. The Court, however, then erred in not invalidating the claims for lack of enablement because their scope is disproportionate to the evidence of unexpected results upon which patentability was granted.

In its response to the PTO’s rejection under §112, ¶1 on lack of enablement, Invista-NA argued that the ’216 Patent teaches a POSITA how to make and use the invention. A2347, A2368-69. Regarding the “use” requirement, Invista-NA relied solely on its data and arguments directed to surprising results. A2369. As a result, Invista-NA intentionally linked the scope of enablement to the evidence of unexpected results. A2369.

There are hundreds of combinations of different metal sulfonate salts for which Invista-NA did not attempt to show “unexpected” results. A7259. But, proffering unexpected results for just one combination is insufficient to support patentability of hundreds of combinations. *Genetics Inst., LLC v. Novartis Vaccines & Diagnostics, Inc.*, 655 F.3d 1291, 1308 (Fed. Cir. 2011) (“[R]ather, we

have rejected unexpected results where the evidence was plainly disproportionate to the scope of the claim.”); *In re Peterson*, 315 F.3d 1325, 1331 (Fed. Cir. 2003) (affirming obviousness when applicant claimed an alloy with 1-3% rhenium, yet showed unexpected results only for 2% rhenium); *In re Grasselli*, 713 F.2d 731, 743 (Fed. Cir. 1983) (finding that unexpected results “limited to sodium only” are not commensurate in scope with claims to a catalyst having “an alkali metal”); *In re Greenfield*, 571 F.2d 1185, 1189 (C.C.P.A. 1978) (affirming obviousness of a genus of “several hundred compounds,” when unexpected results were for “only one” compound).

Invista-NA has not demonstrated that “the great number and variety of compositions included by the claims would behave in the same manner as the single tested composition.”” *In re Lindner*, 457 F.2d 506, 508-509 (C.C.P.A. 1972). Invista-NA merely relied on attorney argument and conclusory expert testimony to assert that all alkali metals would produce results similar to those presented for Na+. *See, e.g.*, A5880 (fn.18). M&G, on the other hand, explained that other alkali metal sulfonate salts will behave differently, and a POSITA would not expect that all metals would show the same purported “unexpected” results. A7259 (¶40), A4513-18. Invista-NA’s failure is fatal to the validity of the ’216 Patent as there is no claim directed to just Na+. *In re Greenfield*, 571 F.2d at 1187-1189 n.15 (“[the] burden of showing *unexpected* results cannot be satisfied

by establishing that one species [preforms a certain way in the claimed composition], coupled with a mere expectation that all related compounds will also [preform that same way in the claimed composition].") (emphasis in original).

The District Court abused its discretion when it failed to grant summary judgment of invalidity of the '216 Patent for lack of enablement. The District Court made an error of law by finding that the full scope of the claims was enabled because Invista-NA asserted that a specific composition (in which only Na⁺ was used) achieved "surprising" results. The District Court should have found the '216 Patent was invalid on summary judgment for lack of enablement.

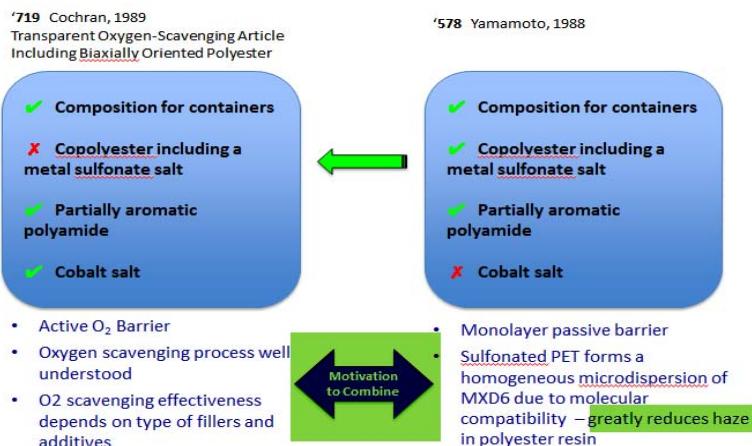
F. The District Court's Refusal To Grant M&G's Request For JMOL On The Issue Of Obviousness Was Legally Erroneous.

The District Court improperly upheld jury findings that were not supported by substantial evidence. In the same way that the PTO made a prima facie case of obviousness for the '216 Patent during prosecution, M&G made a prima facie case of obviousness for the '216 Patent during trial. M&G also proved that a POSITA would have been motivated to combine at least the following references ('719 and '578 Appls.; '266 and '578 Appls.; and '925 and '731 Appls.) to practice the purported invention of the '216 Patent.

For each of the following prior art combinations: '719 and '578 (A13482 (633:20-634:12, 644:5-9)); '266 and '578 (A13482 (647:2-17, 653:2-9)); and '925 and '731(A13482 (621:16-22, 623:8-21)), M&G presented evidence at trial that

proved by clear and convincing evidence that a POSITA would combine an active barrier solution with a passive barrier solution to arrive at the claimed invention. The demonstrative slides (see example below) which Dr. Moore referenced during his trial testimony on the obviousness combinations of the '719 and '578 Appls.; '266 and '578 Appls.; and '925 and '731 Appls., shows the level of detail with which he supported his opinion.

'719 and '578



Dr. Moore testified that a POSITA would be motivated to combine the cited prior art and borrow technology from one to use in the other because the feature of an improved barrier is solved by both. *See, e.g.*, A13501-02 (621:16-22 and 623:8-21), A13507 (644:5-9), A13509 (653:2-9). Dr. Moore's testimony points out specifically why a POSITA would be motivated to combine the various combinations, *e.g.* if a POSITA were interested in reducing the haze caused by the

use of nylon in an active barrier, they would use a compatibilizer, for example, as taught in the ‘578 Appl. A13507 (644:5-9).

Invista’s expert Dr. Turner offered conclusory testimony that there is no motivation to combine the references because they do not “teach reduction in haze or yellowness.” A13576 (890:1-6), *see also* A13576 (903:16-20, 904:15-905:11) A reduction in haze or yellowness, however, is not a requirement of the claims. Claim 1 simply recites three elements with no functional limitation. While the teaching of a solution to a particular problem such as the reduction in haze or yellowness would provide an explicit reason to combine – no such explicit reason is required. *Alza Corp. v. Mylan Labs., Inc.*, 464 F.3d 1286, 1291 (Fed. Cir. 2006). Motivation to combine equally can be found in the knowledge generally available to a POSITA, such as the problem to be solved. *Id.*

Indeed, Dr. Turner’s conclusory testimony that the ‘578 Appl. does not teach a reduction in haze is contradicted by the ‘578 Appl. itself and Dr. Moore’s trial testimony. A13482 (644:5-9). The ‘578 Appl. states “...the transparency is improved and the haze is notably reduced.” A14434 (emphasis added).⁸

⁸ The District Court erroneously held that this quote does not support M&G’s JMOL request because it was not presented to the jury. A131, n.8). The ‘578 Appl. itself was presented to the jury and this citation also was provided to show that the no obviousness finding is against the clear weight of the evidence. During trial, Dr. Moore also provided testimony regarding how SIPA greatly reduces haze in polyester resin. A13482 (623:5-12).

1. A Clear Nexus To The Claimed Merits Of The Invention Has Not Been Established As A Matter Of Law.

Conclusory expert testimony cannot be used by Invista to establish secondary considerations to overcome M&G's prima facie case of obviousness. *In re Kao*, 639 F.3d 1057, 1066 (Fed. Cir. 2011); *Wyers v. Master Lock Co.*, 616 F.3d 1231, 1246 (Fed Cir. 2010). "For objective evidence of secondary considerations to be accorded substantial weight, its proponent must establish a nexus between the evidence and the merits of the *claimed invention*." *In re Kao*, 639 F.3d at 1068 (emphasis in original). Invista did not do this.

Invista alleged an unexpected reduction in yellowness from the claimed invention compared to the prior art, but supported it only with conclusory testimony from its expert Dr. Turner. A13576 (916:15-23). Dr. Turner stated that there is synergy because the data from the patent shows it. A13576 (906:24-907:8). But, Dr. Turner did not perform any analysis other than reading the numbers reported in the patent. Dr. Turner also said that there is synergy because Dr. Liu said so. A13576 (907:9-12). Dr. Turner then said that there was synergy because "there are two commercial products in the marketplace." A13576 (907:13-16). This testimony, however, fails to show that a nexus exists between any unexpected results and the claimed invention. A13576 (916:15-23). In contrast, Dr. Moore provided detailed testimony that any additional reduction in

yellowness over the prior art was due to the supplementary inclusion of sodium acetate. A13482 (686:14-17, 688:10-690:7, 691:17-24).

Invista has not remedied its failure to submit evidence to establish commercial success or the required nexus. M&G's argument that Invista cannot prove commercial success without relative market share data is unrebutted. A11468-69; A13576 (827:3-15). Invista also fails to point to evidence of record that shows customer demand, or that the alleged commercial success is substantially related to the merits of the '216 patent claimed invention.

2. The '216 Patent Is Invalid Because The Scope Of Invista's Unexpected Results Is Broader Than The Scope Of The Claims Of The '216 Patent.

Invista's purported evidence of unexpected results does not overcome the prima facie case of obviousness made by M&G. There are hundreds of combinations of different metal sulfonate salts for which Invista-NA did not attempt to show "unexpected" results. A7259. But, proffering unexpected results for just one combination is insufficient to support patentability of hundreds of combinations. *Genetics Inst., LLC v. Novartis Vaccines & Diagnostics, Inc.*, 655 F.3d 1291, 1308 (Fed. Cir. 2011) ("[R]ather, we have rejected unexpected results where the evidence was plainly disproportionate to the scope of the claim."); *In re Peterson*, 315 F.3d 1325, 1331 (Fed. Cir. 2003) (affirming obviousness when applicant claimed an alloy with 1-3% rhenium, yet showed unexpected results only

for 2% rhenium); *In re Grasselli*, 713 F.2d 731,743 (Fed. Cir. 1983) (finding that unexpected results “limited to sodium only” are not commensurate in scope with claims to a catalyst having “an alkali metal”); *In re Greenfield*, 571 F.2d 1185, 1189 (C.C.P.A. 1978) (affirming obviousness of a genus of “several hundred compounds,” when unexpected results were for “only one” compound).

Invista-NA has not demonstrated that “the great number and variety of compositions included by the claims would behave in the same manner as the single tested composition.” *In re Lindner*, 457 F.2d 506, 508-509 (C.C.P.A. 1972). Invista-NA merely relied on attorney argument and conclusory expert testimony to assert that all alkali metals would produce results similar to those presented for Na⁺. *See, e.g.*, A5880, n.18. M&G, on the other hand, explained that other alkali metal sulfonate salts will behave differently, and a POSITA would not expect that all metals would show the same purported “unexpected” results. A7259 (¶40); A4513-18. Invista-NA’s failure to show unexpected results as to more than a single alkali metal is fatal to the validity of the ‘216 Patent because there is no claim directed to just Na⁺. *In re Greenfield*, 571 F.2d at 1187-1189 n.15 (“[the] burden of showing *unexpected* results cannot be satisfied by establishing that one species [performs a certain way in the claimed composition], coupled with a mere expectation that all related compounds will also [perform that same way in the claimed composition].”) (emphasis in original).

Accordingly, the District Court’s conclusion that “plaintiffs presented evidence of secondary considerations” is erroneous. The evidence of record can lead to only one conclusion regarding obviousness – Invista’s evidence of secondary considerations is insufficient and fails as a matter of law. *In re Kao*, 639 F.3d at 1068. Under the proper legal analysis, all of the asserted claims of the ‘216 Patent are invalid as obvious.

G. The Permanent Injunction Should Be Vacated Or Alternatively, Narrowed And Modified To Include A Transition Period

The District Court committed legal and factual errors in granting a permanent injunction against M&G. The District Court misapplied the four factor *eBay* test, which requires a finding under the following factors: irreparable injury, inadequacy of remedies at law, the balance of hardships between the parties, and the public interest. *eBay Inc. v. MercExchange, L.L.C.*, 547 U.S. 388, 391 (2006). The District Court’s grant of the injunction violated at least the irreparable harm and public interest factors. *Monsanto Co. v. Geertson Seed Farms*, 130 S. Ct. 2743, 2761 (2010) (“An injunction is a drastic and extraordinary remedy, which should not be granted as a matter of course.”) (citing *Weinberger v. Romero-Barcelo*, 456 U.S. 305, 311-12 (1982)). “If a less drastic remedy . . . [is] sufficient to redress [a plaintiff’s] injury, no recourse to the additional and extraordinary relief of an injunction [is] warranted.” *Id.*

1. The District Court Abused Its Discretion By Granting the Permanent Injunction

a. The District Court incorrectly found irreparable harm.

The District Court erred in holding that, “with only two manufacturers of monolayer products in the market, … a ‘sale to defendant is the loss of a sale to plaintiff.’” A155-56. As Invista admitted, although it and M&G are direct competitors, they are not the only companies offering “high barrier” monolayer polyester barrier resins in the market. A152; *see also* A13082; A13576 (827:17-828:8). There are four different manufacturers of such resins competing for the same customers: (1) M&G (PoliProtect AB and JPB), (2) Auriga (Oxyclear and PolyShield), (3) Constar International (Monoxbar), and (4) Colormatrix Corp. (Amosorb). A13082.

Even though the District Court defined the relevant market as the “barrier polyester market, [which] includes monolayer, multilayer, and coated containers,” it applied a more restricted market definition when granting the injunction. The District Court considered a market that only included monolayer barrier resins. A153. The District Court then erroneously applied law directed to a two competitor market to find irreparable harm. A155-56. This finding is directly against the clear weight of the evidence. Invista and M&G compete for the same customers as businesses that sell glass containers, metal containers, coated

containers, and multi-layer PET containers. A11426 (94:10-23); A11437 (38:1-40:12).

The District Court further erred in finding that Invista proved a sufficient nexus between the alleged harm and infringement. *See Apple, Inc. v. Samsung Electronics Co.*, 678 F.3d 1314, 1324 (Fed. Cir. 2012). There is no nexus connecting sales of M&G's Products to lost sales of Invista's PolyShield. First, PolyShield itself, which is lacking nylon, is not a commercial embodiment of the '216 Patent. A13576 (924:14-17). Second, the patented M&G BiCo pellet, a feature not covered by the '216 Patent, is a key driver of customer demand for M&G Products. *See, e.g.*, A13482 (569:19-571:24); A11376 (107:23-109:17). A customer does not have to separately purchase and add nylon as it would with PolyShield. A11376 (112:6-113:2).

b. The District Court ignored the public interest in granting an injunction.

Moreover, there is a strong public interest in maintaining a supply of food and beverage products in the market. *See E.I. DuPont de Nemours & Co. v. Phillips Petroleum Co.*, 835 F.2d 277, 278-79 (Fed. Cir. 1987) (staying injunction pending appeal in part because of an immediate market shortage). The District Court erred when it summarily concluded that the public interest factor is neutral. A157. Substantial and irreparable harm is caused each day of the on-going injunction to M&G's customers, their downstream customers, and consumers who

purchase food products and beverages in barrier enabled packaging and bottles.

Doc. 3, Exh. 13. *See Brocade Communs. Sys. v. A10 Networks, Inc.*, 2013 U.S.

Dist. LEXIS 18870 *36; 2013 WL 557102 (N.D. Cal. 2013)(finding that “the public interest requires [a] court [to] mitigate the effects of the injunction on third parties - including [Defendant’s] customers”).

Customers cannot readily switch between barrier resins “as customers would have to qualify [the new] resin for their products and purchase additional equipment” which “is costly and takes about a year.” A154, n.27. Invista’s PolyShield product is not a drop-in replacement for PoliProtect because of the need for a transition period and the requirement to add nylon. The District Court did not properly consider this harm to these third parties in balancing the hardships.

Immediate removal of the M&G Products from the market will have a drastic negative effect on third parties that outweighs the public interest in upholding Invista’s patent rights – rights that Invista does not even practice. A11384 (48:17-49:1). *See GTE Prods. Corp. v. Kennametal, Inc.*, 772 F. Supp. 907, 920 (W.D. Va. 1991) (staying injunction because of concerns about patentee’s ability to adequately supply the demand and absence of a comparable product).

c. The District Court abused its discretion in granting the injunction.

Thus, it was an abuse of discretion for the District Court to enter an injunction against M&G. Due to the Court’s erroneous findings and

misapplication of the law to the facts, the permanent injunction should be vacated. Invista has not suffered, and will not suffer, irreparable harm from M&G's alleged infringement. Any harm suffered by Invista is quantifiable and compensable with money damages. Moreover, the strong public interest counsels against the injunction.

2. The District Court Erred By Not Narrowly Tailoring The Injunction And Extending It To Enjoin Exports.

The District Court's injunction order improperly enjoined M&G from making and exporting the M&G Products under 35 U.S.C. §271(f). In its Motion for Permanent Injunction, Invista expressly stated that: “Plaintiffs’ request for an injunction is **not based** on infringement under Section 271(f).” A11665 (emphasis added). Thus, Invista did not even seek relief for infringement under §271(f) for the ‘216 Patent. A271-280. The District Court abused its discretion in enjoining M&G and granting such relief.

The District Court ruled at summary judgment that M&G did not directly infringe, but only indirectly infringed, the ‘216 Patent. A102. “[A] trial court, upon finding infringement, must narrowly tailor an injunction to fit the specific adjudged violations. … An injunction cannot impose unnecessary restraints on lawful activity.” *Riles v. Shell Exploration and Prod. Co.*, 298 F.3d 1302, 1311 (Fed. Cir. 2002.). The injunction imposed by the District Court in this case was not narrowly tailored. The proper scope of an injunction should have been limited

to the requested relief - to enjoin M&G from indirectly infringing the ‘216 Patent in the U.S. by preventing M&G from selling PoliProtect to U.S. customers that then complete the alleged infringing act, *i.e.*, melting the pellets, in the U.S. *See Riles*, 298 F.3d at 1311.

3. Any Injunction Should Include A Transition Period.

At the very minimum, the District Court erred in issuing an injunction without a transition period. A transition period “mitigate[s] the harm to the public” while protecting a patentee’s rights. *Halo Elecs., Inc. v. Pulse Elecs., Inc.*, 2013 U.S. Dist. LEXIS 99772, *8, (D. Nev., July 13, 2013), (*citing Broadcom Corp. v. Qualcomm Inc.*, 543 F.3d 683, 701-04 (Fed. Cir. 2008) (affirming a transition provision because it properly “balance[d] the policy of protecting the patentee’s rights against the desirability of avoiding immediate market disruptions” (internal quotations omitted))).

Customers for M&G’s Products need to transition to alternatives. M&G (A13081-84), Auriga (A11278-86), and M&G’s customer Amcor (Doc. 3, Ex. 13) agree that the time required for a customer to qualify a replacement barrier resin is one year. A13084, ¶17; A11285, ¶25; Doc. 3, Ex. 11, ¶25. The District Court acknowledged this in its Memorandum Order. A154, n.27. At a minimum, any injunction should include an adequate transition provision, *e.g.*, one year, to protect third-party interests.

H. The District Court Made Additional Errors That Warrant Reversal

M&G's first motion to amend the pleadings to include a charge of inequitable conduct was timely filed under the scheduling order (A174) in August 2012. A179. The parties' related briefing completed in September 2012, at which time M&G requested leave to further amend if the court desired additional factual pleading. A995, n.6. During the pendency of that motion, M&G continued to discover new evidence from Invista's massive production relevant to invalidity and inequitable conduct. A8743-44. In the intervening months it became clear that there were overwhelming inconsistencies between the data produced to support patentability and the versions of that data submitted to the PTO.⁹ A8619-642. For example, claim 1 of '216 patents, and other claims, would not have issued if this information were properly disclosed because it shows that the inventors were not in possession of the purported unexpected results. A8735-7.

In May 2013, M&G's first motion to amend was denied for lacking specificity regarding "who" the allegations were directed towards. A8182-87.

In June 2013, M&G filed a second motion to amend, setting forth a detailed pattern of deceit (A8732-33) undertaken by Invista-NA's patent liaison, Dr. Scantlebury, that evidenced intent to defraud the PTO. A8606. *Intellect Wireless, Inc. v. HTC Corp.*, 732 F.3d 1339 1345-46 (Fed. Cir. 2013). Knowing the

⁹ Invista produced over 180,000 native Excel spreadsheets of data, along with another 800,000 plus pages of other documents.

seriousness of an inequitable conduct charge and the District Court's Order, M&G took seven weeks, between the entry of the Order and the filing of the second motion, to confirm the accuracy of its allegations and draft detailed, updated allegations with the heightened particularity required under *Exergen Corp. v. Wal-Mart Stores, Inc.*, 575 F.3d 1312 (Fed. Cir. 2009). A8745, ¶12; A8742-46.

M&G detailed its diligence, describing that any delay in its filing was a function of the complexity of sorting through Invista's massive production. A8729-31. The District Court summarily denied M&G's request, citing a failure to offer a "sufficient explanation for their undue delay" and that Invista would be unduly prejudiced. A159. The District Court erred when it denied M&G's second motion to amend and finding prejudice to Invista even though all relevant evidence lies within the scope of Invista's knowledge and control. *Roquette Freres v. SPI Pharma, Inc.*, C.A. No. 06-540, 2009 WL 1444835, at *5 (D. Del. May 21, 2009) (granting a defendant leave to amend the pleadings after the scheduling deadline in order for the defendant to confirm its factual inequitable conduct allegations through discovery in light of the pleading with particularity requirement under Rule 9(b)). The damages phase of this case has yet to begin. No hearing on inequitable conduct was set and Invista would have sufficient time to try the issue of inequitable conduct separately. Thus, the District Court's Order should be reversed.

M&G also requests that this Court review the District Court's denial of M&G's motion for reargument on the overturning the Magistrate's order granting M&G's motion to compel certain documents. A159-160. Fed. R. Civ. Pro. 72(a) permits a district judge to overrule a magistrate's order upon a finding that is was "clearly erroneous" or "contrary to law." In his thirty-nine page order (A9415-53), Magistrate Burke detailed that Invista had failed to meet their burden to prove several claimed assertions of privilege, and recommended compelling Invista to produce fifty-two documents to M&G, two of which further support M&G's charge of inequitable conduct. A9434; A9442-44; A9447-452. Magistrate Burke also held that although under his interpretation of the Protective Order, M&G's motion to compel may have been untimely, M&G showed a good faith belief that it was timely filed and allowed the motion to stand. A9418, n.1. In its review, the District Court stated in its oral order that while it had "appreciate[d] the fact that [Magistrate] Judge Burke wrote 39 pages on [this] discovery dispute, [the District Court] was stopped in the first couple pages ... [and] didn't get beyond that." A13253 (19:7-13). The District Court abused its discretion by failing to address the merits of the Magistrate's Order, or point out in any fashion that is was "clearly erroneous" or "contrary to law." A10795. As a result, the District Court's refusal to grant M&G's motion to compel certain documents should be vacated.

VI. CONCLUSION AND STATEMENT OF RELIEF

For the reasons stated, this Court should reverse the Judgments and Orders that M&G appealed from as it requested, enter judgment for M&G as indicated, and vacate the permanent injunction. Alternatively, this Court should remand for a new trial with appropriate instructions.

The District Court misconstrued the claims. It prevented M&G from presenting its non-infringement arguments and precluded testimony. It ignored the evidence in finding the claims valid and not obvious. And it abused its discretion in granting a permanent injunction when there was no irreparable harm and the public interest weighed against doing so.

Dated: May 13, 2014

Respectfully submitted,

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ADDENDUM

ADDENDUM
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IN THE UNITED STATES DISTRICT COURT
FOR THE DISTRICT OF DELAWARE

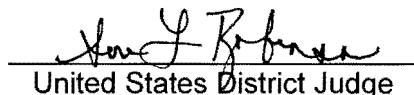
INVISTA NORTH AMERICA S.A.R.L.,)
and AURIGA POLYMERS INC.,)
)
Plaintiffs,)
)
v.) Civ. No. 11-1007-SLR/CJB
)
M&G USA CORPORATION and M&G)
POLYMERS USA, LLC,)
)
Defendants.)

O R D E R

At Wilmington this ~~30~~¹ day of May, 2013, having considered the Report and Recommendation of United States Magistrate Judge Christopher J. Burke issued on April 30, 2013, and upon the expiration of the time allowed for objections pursuant to Rule 72 of the Federal Rules of Civil Procedure with no objection having been filed;

IT IS ORDERED that:

1. Magistrate Judge Burke's Report and Recommendation (D.I. 339) is adopted.
2. Defendants' motion for leave to amend the pleadings (D.I. 91) is denied.



United States District Judge

IN THE UNITED STATES DISTRICT COURT
FOR THE DISTRICT OF DELAWARE

INVISTA NORTH AMERICA S.A.R.L.)
and AURIGA POLYMERS INC.,)
Plaintiffs,)
v.) Civ. No. 11-1007-SLR-CJB
M&G USA CORPORATION and M&G)
POLYMERS USA, LLC,)
Defendants.)

MEMORANDUM ORDER

At Wilmington this 25th day of June, 2013, having considered three motions to exclude or strike filed by plaintiffs INVISTA North America S.à.r.l. and Auriga Polymers Inc. (collectively, "Invista") and defendants M&G USA Corporation and M&G Polymers USA, LLC (collectively, "M&G") (D.I. 253; D.I. 284; D.I. 340);

IT IS ORDERED that said motions are granted in part and denied in part, as follows:

1. Background. Invista is suing M&G for infringement of United States Patent Nos. 7,919,159 (“the ‘159 patent”), 7,943,216 (“the ‘216 patent”), and 7,879,930 (“the ‘930 patent”) (collectively, “the patents-in-suit”). (D.I.1; D.I. 7) Before the court are three motions to exclude or strike testimony: Invista’s motion to strike portions of Dr. Robert B. Moore’s reply expert report and Dr. Moore’s references to and reliance upon certain experimental data (“Invista’s first motion to strike”) (D.I. 253); M&G’s motion to exclude Dr. Richard S. Turner’s testimony regarding infringement and secondary

considerations (“M&G’s motion to exclude”) (D.I. 284); and Invista’s motion to strike M&G’s summary declaration and supplemental interrogatory response regarding M&G’s core documents (“Invista’s second motion to strike”) (D.I. 340).

2. Pursuant to the scheduling order in this case and subsequent amendments, fact discovery closed on October 5, 2012; expert reports were due December 14, 2012; rebuttal reports were due January 21, 2013; reply reports were due February 1, 2013; and expert discovery closed February 20, 2013. (D.I. 18; D.I. 144; D.I. 151) The parties stipulated that the reply reports would be limited to the topic of “secondary considerations of obviousness.”¹ (D.I. 18 at ¶ 2(d)(1)) The scheduling order also provides that “[s]upplementations under Rule 26(e) [are] due as required by the rule.”² (*Id.* at ¶ 2(e)) Trial is set to begin on July 17, 2013. (*Id.* at ¶ 12)

3. **Legal standards.** The court evaluates discovery issues in patent cases under Third Circuit law. See *Dow Chem. Co. v. Nova Chems. Corp.*, 2010 WL 2044931, at *1 (D. Del. May 20, 2010). Pursuant to Federal Rule of Civil Procedure 26(a)(2)(D), parties must disclose expert testimony “at the times and in the sequence that the court orders.” If a party “learns that in some material respect the disclosure or response is incomplete or incorrect, and if the additional or corrective information has not otherwise been made known to the other parties during the discovery process or in

¹The subsequent amendments to the scheduling order did not change this language; they only changed the deadlines. (See D.I. 141; D.I. 155)

²Rule 26(e)(2) provides for supplementation to expert reports or disclosures “by the time the party’s pretrial disclosures under Rule 26(a)(3) are due.” Pursuant to the scheduling order and D. Del. LR 16.4, M&G’s initial pretrial disclosures were due on June 5, 2013.

writing," it must supplement or correct its disclosure. Fed. R. Civ. P. 26(e). "However, parties may not use their obligation to supplement as an excuse to violate the clear terms of a scheduling order, unilaterally buying themselves additional time to make disclosures, thereby unduly prejudicing other parties and potentially delaying the progress of a case." *Abbott Labs. v. Lupin Ltd.*, Civ. No. 09-152, 2011 WL 1897322, at *3 (D. Del. May 19, 2011). When expert testimony is not timely disclosed, the court has the authority to exclude it from evidence. See *United States v. 68.94 Acres of Land*, 918 F.2d 389, 396 (3d Cir. 1990).

4. Exclusion of expert opinion and testimony may occur under Rules 37 or 16(f). Under Rule 16(f), the court may impose sanctions if, *inter alia*, a party or its attorney "fails to obey a scheduling order or other pretrial order." Fed. R. Civ. P. 16(f). Under Rule 37(c)(1), a party that fails to comply with Rule 26(a) or (e) (regarding failure to disclose or supplement) "is not allowed to use that information or witness to supply evidence on a motion, at a hearing, or at a trial, unless the failure was substantially justified or is harmless." Fed. R. Civ. P. 37(c)(1). Courts in the Third Circuit consider five factors when deciding whether to preclude evidence under Rule 37: (1) the prejudice to or surprise of the party against whom the evidence is offered; (2) the ability of that injured party to cure the prejudice; (3) the likelihood of disruption of trial; (4) the bad faith or willfulness involved in not complying with the disclosure rules; and (5) the importance of the evidence to the proffering party ("the Meyers factors"). See *Konstantopoulos v. Westvaco Corp.*, 112 F.3d 710, 719 (3d Cir. 1997) (citing *Meyers v. Pennypack Woods Home Ownership Ass'n*, 559 F.2d 894, 904-05 (3d Cir. 1977)). "Courts must . . . be mindful that the 'exclusion of critical evidence is an 'extreme'"

sanction, not normally to be imposed absent a showing of willful deception or “flagrant disregard” of a court order by the proponent of the evidence.” *Tracinda Corp. v. DaimlerChrysler AG*, 362 F. Supp. 2d 487, 506 (D. Del. 2005) (citation omitted).

5. The Supreme Court in *Daubert v. Merrell Dow Pharm., Inc.*, 509 U.S. 579, 600 (1993), made clear that courts have to play a gatekeeping role with respect to experts. According to the Supreme Court, Rule 702 of the Federal Rules of Evidence³ is the primary locus of the gatekeeping role. Pursuant to Rule 702, a party can offer testimony of an expert witness at trial so long as the expert is qualified, the methodology the expert uses is reliable, and the opinion fits the facts of the case. See *Elcock v. Kmart Corp.*, 233 F.3d 734, 741 (3d Cir. 2000). A trial judge, then, is tasked with being a “gatekeeper” to ensure that ‘any and all expert testimony is not only relevant, but also reliable.’ *Pineda v. Ford Motor Co.*, 520 F.3d 237, 243 (3d Cir. 2008).

6. **Invista’s first motion to strike.** Invista’s first motion to strike seeks to strike various opinions provided by Dr. Moore, M&G’s expert. First, Invista contends that 46 pages of Dr. Moore’s 52-page reply expert report on invalidity are untimely and

³Rule 702 provides:

If scientific, technical, or other specialized knowledge will assist the trier of fact to understand the evidence or to determine a fact in issue, a witness qualified as an expert by knowledge, skill, experience, training, or education may testify thereto in the form of an opinion or otherwise, if (1) the testimony is based upon sufficient facts or data, (2) the testimony is the product of reliable principles and methods, and (3) the witness has applied the principles and methods reliably to the facts of the case.

Fed. R. Evid. § 702.

improper because they address topics beyond secondary considerations. (D.I. 254 at 4 n.4, 16-17) M&G contends that those 46 pages are a supplement to Dr. Moore's opening expert report, timely filed on February 1, 2013, the deadline for expert reply briefs, and permissible under Rule 26(e). (D.I. 301 at 4-6) The court finds that, although not labeled as such, the 46 pages at issue were submitted in response to arguments in Dr. Turner's rebuttal report that Dr. Moore's report was incomplete for failing to specifically cite support for his opinions. Thus, viewed as a supplement, those 46 pages ("Dr. Moore's supplement") were timely filed and appropriately clarified Dr. Moore's opening report. They included only subject matter that was originally disclosed in Dr. Moore's opening report and presented no new or changed opinions. Even if there were some prejudice, such prejudice was curable by Invista. Dr. Moore's supplement was provided to Invista nearly a week before Dr. Turner's deposition (which, in any case, focused on Dr. Turner's report); about two weeks before Dr. Moore's deposition; and about three weeks before the close of expert discovery. (See *id.* at 7-8; see also D.I. 322 at 7 n. 7) Invista had ample opportunity to prepare for Dr. Moore's deposition and, in fact, questioned him about the supplement. Invista has not made a showing that Dr. Moore's supplement would likely disrupt trial or that M&G made a bad faith or willful attempt to avoid complying with the scheduling order. At the same time, Dr. Moore's supplement is of high importance to M&G because it provides supporting citations to his previously disclosed opinions. In light of these considerations, the court does not find exclusion of Dr. Moore's supplement to be warranted.

7. Invista also asks the court to strike Dr. Moore's reference to testing done by PET Processors LLC and Plastic Technologies, Inc. ("the PET and PTI experiments"),

which Dr. Moore used to form his invalidity opinion of non-enablement of the '159 and '216 patents. (D.I. 254 at 2-3) Federal Rule of Civil Procedure 26(a)(2)(B)(ii) requires disclosure of "the facts or data considered by the witness in forming [his or her opinions]." According to Invista, M&G selectively withheld information, such that the test data and results provided to Invista were "an incomplete set of all facts and data considered in forming [Dr. Moore's] opinions."⁴ (D.I. 322 at 9; see also D.I. 254 at 10-12) Invista mainly supports its argument by alleging that M&G failed to initially provide all information that Dr. Moore considered and has subsequently engaged in "a pattern of conduct" to improperly block discovery related to the PET and PTI experiments. (D.I. 254 at 4, 8, 18) M&G asserts that it has produced all facts and data that Dr. Moore "considered or relied on" in forming his invalidity opinions and that any additional information that Invista seeks is privileged, under Rule 26(b)(4)(C)(ii), as "communications [that] identify facts or data that the party's attorney provided and that the expert considered in forming the opinions to be expressed." (D.I. 301 at 10; D.I. 302 at ¶ 11) The court, at this time, does not find the extreme sanction of precluding all references and reliance on the PET and PTI experiments to be appropriate and will deny Invista's motion with respect to Dr. Moore's references to and reliance upon that data. However, to the extent the parties' dispute regarding the scope of disclosure is premised on different interpretations of what constitutes data "considered" by an expert

⁴Citing to language in Dr. Moore's objections and response to a subpoena, Invista contends that Dr. Moore's reports only attached materials that were "relied on" by Dr. Moore. (D.I. 254 at 7) (citing D.I. 255, ex. 9 at 5-6) However, Dr. Moore's cited response merely mirrored the language used by Invista in its document request, which asked for information "relied on" by Dr. Moore in preparing his expert reports. (See D.I. 255, ex. 9 at 5)

in the context of Rule 26, the court notes that M&G cannot withhold data from the PET and PTI experiments, even if Dr. Moore “relied on” only selected portions of the data.⁵ Therefore, if it has not done so already, M&G must provide Invista with all of the data and results from the PET and PTI experiments.

8. Invista also asks the court to strike portions of Dr. Moore’s April 8, 2013 declaration (“Dr. Moore’s declaration”) (D.I. 304) submitted with M&G’s reply brief for summary judgment of invalidity. (See D.I. 322 at 2) Upon careful review, the court agrees with Invista that Dr. Moore’s declaration contains previously undisclosed theories of invalidity in all or portions of paragraphs 7-8, 10, 13-17, 19, 31-35, 37, 44 and 51.⁶ (See *id.* at 5-6) To allow these new expert opinions, in the middle of summary judgment briefing and just prior to trial, would unduly prejudice Invista.⁷ Therefore, the court grants Invista’s motion to strike with respect to the following new material in Dr.

⁵As amended, Rule 26 now protects drafts and certain communications between a party’s attorney and a testifying expert from disclosure. Fed. R. Civ. P. 26(b)(4)(B) & (C). However, those amendments “do not impede discovery about the opinions to be offered by the expert or the development, foundation, or basis of those opinions. For example, the expert’s testing of material involved in litigation, and notes of any such testing, would not be exempted from discovery by this rule.” Fed. R. Civ. P. 26 advisory committee’s note.

⁶However, contrary to Invista’s request, the court does not strike (1) Dr. Moore’s opinion that sodium and lithium will likely behave differently (D.I. 304 at ¶ 40) or (2) his opinions concerning the ‘930 patent’s indefiniteness (*id.* at ¶ 55). Dr. Moore opined on the difference between lithium and sodium in his rebuttal infringement report. (See D.I. 237 at PA153 n.4) In addition, he asserted indefiniteness in his opening report as a theory for invalidity of the ‘930 patent. (See D.I. 255, ex. 5 at 54, 58)

⁷M&G has not attempted to justify the admissibility of Dr. Moore’s declaration, either in briefing on Invista’s first motion to strike or in briefing on summary judgment of invalidity.

Moore's declaration:⁸

- a. Opinion that the '925 reference discloses a resin "having both passive and active barrier properties." (*D.I. 304* at ¶ 7)
- b. The teaching of the Moore reference and opinion regarding the N66 nylon polar polymer. (*Id.* at ¶¶ 8, 10)
- c. Opinions regarding the combination of the '925 and Moore references. (*Id.* at ¶¶ 9-10, 13-17)
- d. Opinions that "there is no nexus between any claimed feature and the reduction of yellowness unless the amount of sodium acetate . . . is more than twice the amount necessary to buffer DEG." (*Id.* at ¶ 19)
- e. Opinions and graphs regarding allegedly withheld internal information about yellowness and b* values. (*Id.* at ¶¶ 31-35)
- f. Opinions that the '159 and '216 patents teach away from suppressing the formation of DEG. (*Id.* at ¶ 37)
- g. Opinions concerning differences in the disclosure of colorants between the provisional and non-provisional applications of the '930 patent. (*Id.* at ¶ 44)
- h. Opinions regarding the patentee's alleged inconsistency in disclosing the purity or dilution of colorants. (*Id.* at ¶ 51)

9. M&G's motion to exclude. M&G moves to exclude the testimony of Invista's

⁸These portions of Dr. Moore's declaration are also excluded for violating Local Rule 7.1.3(c)(2), which provides that "[t]he party filing the opening brief shall not reserve material for the reply brief which should have been included in a full and fair opening brief." D. Del. LR 7.1.3(c)(2). M&G filed Dr. Moore's declaration with its reply brief for summary judgment of invalidity in an improper effort to support the invalidity arguments that it made in its opening brief. (See D.I. 234; D.I. 303)

expert, Dr. Turner, regarding infringement and secondary consideration regarding validity. (D.I. 284) M&G argues that Dr. Turner's infringement opinions are not reliable because he did not perform any testing, instead using the "arbitrary" assumption that the ingredients listed on M&G's core technical documents are present in the accused PoliProtect APB and PoliProtect JB products (collectively, "the PoliProtect products"). (D.I. 288 at 1-3, 5) (citing D.I. 286, ex. A at ¶¶ 147-48, 303-04, 393-94, ex. C at 86:19-87:15) In addition, M&G contends that Dr. Turner, a synthetic chemist, is unqualified to offer opinions on secondary considerations (D.I. 286, ex. B at ¶¶ 380-438) because he "has never sold resin, worked in a sales or marketing capacity, or any other field in which he would interact with the relevant consuming public that would give him experience in, or an understanding of, the resin market, customer purchasing behavior, or sales activities." (D.I. 288 at 4, 12-15) M&G also contends that Dr. Turner is not competent to testify regarding copying of the inventions of the patents-in-suit, and his opinions regarding secondary considerations are merely a summary of information contained in other documents and testimony. (*Id.*)

10. Testing is not required to support an infringement opinion; rather, "a patentee may prove infringement by 'any method of analysis that is probative of the fact of infringement.'" *Mkt. Biosciences Corp. v. Nutrinova, Inc.*, 579 F.3d 1363 (Fed. Cir. 2009). Dr. Turner's infringement analysis considered the patents-in-suit and M&G's core technical documents, among other information, and M&G certified its core technical documents as "[t]he composition of . . . [the] PoliProtect . . . products." Therefore, the court does not exclude Dr. Turner's testimony for being unreliable. The court also rejects M&G's argument with respect to Dr. Turner's qualifications for offering

secondary consideration opinions and his competency for opining on copying. While Dr. Turner is not an economist or formally trained in polymer resin sales, he possesses over 40 years of experience as a polymer chemist, of which he spent over 30 years in the polymer industry, including designing polymers with commercial potential. (See D.I. 321, ex. 1 at ex. A) The court finds that Dr. Turner's qualifications meet the liberal standard for "specialized knowledge" under Federal Rule of Evidence 702. Therefore, the court denies M&G's motion. To the extent M&G disputes the assumptions underlying Dr. Turner's testimony and his qualifications, such disagreements are more properly reserved for cross-examination.

11. Invista's second motion to strike. In addition, Invista moves the court to strike Dr. Moore's March 25, 2013 declaration ("the supplemental declaration") (D.I. 266, ex. G) in support of M&G's summary judgment brief on non-infringement and a supplemental interrogatory response served by M&G on April 29, 2013 ("the supplemental interrogatory response") (D.I. 342, ex. F). (D.I. 340) Invista contends that the supplemental declaration and supplemental interrogatory response are untimely and set forth a new non-infringement defense that M&G's core technical documents do not reflect the composition of the final PoliProtect products. (D.I. 341 at 1) M&G contends that the supplemental declaration and supplemental interrogatory response are proper under Rule 26(e) because they serve to correct material information. (D.I. 346 at 8)

12. M&G produced the core technical documents related to the accused products underlying this dispute during discovery. (D.I. 30) On February 22, 2012,

M&G responded to Invista's interrogatory no. 1⁹ by verifying that "[t]he composition of, and the details requested related to, Defendants' PoliProtect APB and PoliProtect JB products" had been produced as the core technical documents. (D.I. 237 at PA 189-90) Subsequently, Invista's infringement contentions consistently referred to and relied on the core technical documents for the composition of the PoliProtect products, and M&G did not raise any non-infringement defense on the ground that such reliance was inappropriate. (See D.I. 342, ex. D) During discovery, Gianluca Ferrari, whom M&G identified as the person with the most knowledge of the compositions of the accused products, confirmed in his deposition that the core technical documents were "reflective" of the components of the PoliProtect products made or sold in the United States. (See *id.*, ex. E at 14:11-20; D.I. 299 at PA655-57) M&G's expert, Dr. Moore, never opined in his non-infringement report that the core technical documents were unreliable or that they did not reflect the compositions of the PoliProtect products. (D.I. 237 at PA127-83) Now, M&G seeks to argue that the core technical documents describe only the starting ingredients of the PoliProtect products, not the compositions of the **final** products, and that it has no information about or way of knowing the contents of the final products. (D.I. 266 at 26; D.I. 342, ex. F at 4) Essentially, M&G wants to present a non-infringement defense that Invista lacks evidence regarding the compositions of the PoliProtect products. (See D.I. 266 at 26) M&G raised this defense for the first time on March 25, 2013, during summary judgment briefing. (*Id.* at

⁹Invista's interrogatory no. 1 asked M&G to "[d]escribe fully and with particularity the composition of each Accused M&G Product . . . , including by identifying the chemical entity, amount, and function of each and every component of such product" (D.I. 342, ex. B)

25-27) M&G submitted the supplemental declaration to this effect and, following the summary judgment hearing, submitted the supplemental interrogatory response also to this effect. (*Id.*, ex. G; D.I. 342, ex. F)

13. The court finds that M&G's defense regarding the core technical documents not reflecting the composition of the final PoliProtect products is new and untimely. This defense alters the entire infringement and non-infringement landscape that was developed and vetted during fact and expert discovery.¹⁰ Moreover, the court finds M&G's contention that its initial interrogatory response put M&G on notice of its defense to be insufficient; instead, M&G's response made an unqualified representation that the core technical documents reflect the composition of the PoliProtect products. M&G was aware of Invista's infringement theories and even confirmed to the court that its own non-infringement theories were premised on its proposed claim construction, not the sufficiency of the core technical documents. (See D.I. 237 at PA426-27) At best, M&G stood by silently as Invista relied on the core technical documents to establish the PoliProtect products' compositions. At worst, M&G purposefully disregarded the scheduling order and engaged in trial by ambush with its eleventh-hour defense. Either way, to allow M&G's belated new non-infringement theory would substantially prejudice Invista. Such prejudice would be almost impossible to cure at this stage of litigation

¹⁰The court is not persuaded by M&G's citations to deposition testimony confirming that various components were "ingredients" in the PoliProtect products. (See D.I. 346 at 2-7) While such testimony confirmed that components listed in the core technical documents were ingredients, they did not put Invista on notice that those ingredients were not also components in the final PoliProtect products. Read in the context of M&G's interrogatory responses, the rest of the deposition testimony, and M&G's representations to the court, M&G did not dispute during discovery that the core technical documents described the composition of the PoliProtect products.

because Invista has relied on the core technical documents to this stage to establish the foundation of essential evidence – the PoliProtect products' components. Rule 26(e) "is designed to prevent a party from surprising his adversary by setting forth new facts . . . not disclosed during the discovery process." *PIC Inc. v. Prescon Corp.*, 485 F. Supp. 1299, 1301 (D. Del. 1980). The court finds that M&G's new defense is untimely and highly prejudicial and, thus, grants Invista's motion to strike M&G's supplemental declaration and supplemental interrogatory response regarding the core technical documents.

14. Conclusion. For the foregoing reasons, the court grants in part and denies in part Invista's first motion to strike. (D.I. 253) The court grants the motion only to the extent Dr. Moore's declaration filed on April 8, 2013 contains previously undisclosed opinions and testimony. In addition, the court denies M&G's motion to exclude (D.I. 284), and grants Invista's second motion to strike.¹¹ (D.I. 340)



United States District Judge

¹¹Invista's request for costs and fees associated with its second motion to strike is denied. (D.I. 340)

IN THE UNITED STATES DISTRICT COURT

FOR THE DISTRICT OF DELAWARE

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Defendants.)

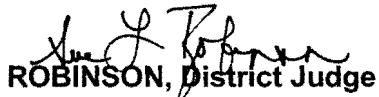
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MEMORANDUM OPINION

Dated: June 25, 2013
Wilmington, Delaware



ROBINSON, District Judge

I. INTRODUCTION

Plaintiffs INVISTA North America S.à.r.l. and Auriga Polymers Inc.¹ (collectively, "Invista") are suing M&G USA Corporation and M&G Polymers USA, LLC (collectively, "M&G") for infringement of United States Patent Nos. No. 7,919,159 ("the '159 patent"), 7,943,216 ("the '216 patent"), and 7,879,930 ("the '930 patent") (collectively, "the patents-in-suit"). (D.I. 1; D.I. 7) M&G has asserted counterclaims seeking declaratory judgment of non-infringement and invalidity of the patents-in-suit. (D.I. 42) The patents-in-suit relate to plastic materials with applications in packaging for oxygen-sensitive foods and beverages. Currently before the court is claim construction, for which the court held a *Markman* hearing on April 19, 2013. The court has jurisdiction over this matter pursuant to 28 U.S.C. § 1338.

II. BACKGROUND

A. Technology Overview

Plastic polymers are commonly used for making food and beverage containers and offer several advantages over the use of glass or metal. They are lighter in weight, have less breakage, and can potentially lower costs. ('216 patent, col. 1:25-27)² Polymers are synthesized by reacting monomers to form a larger polymer chain, and they can be made into bottles by a method called stretch blow molding. In stretch blow molding, a polymer resin is typically dried, melted and extruded into preforms. (*Id.*, col.

¹Auriga Polymers Inc. was added as a plaintiff by a joint stipulation entered by the court on April 30, 2012. (D.I. 52)

²As the '159 and '216 patents share a specification, the court will cite to the '216 patent for convenience, except when discussing the '159 patent in particular.

7:56-58) The preforms are then heated and blown-molded into bottles of desired shape and size. (*Id.*, col. 7:62-64)

One type of polymer, polyester, has been widely used in the bottling industry for many years. Polyethylene terephthalate (“PET”) is a common example of a polyester. (*Id.*, col. 2:34, 8:16) Polyesters can be prepared by reacting diesters (e.g., dicarboxylic ester) or diacids (e.g., terephthalic acid) with ethylene glycol (“EG”). (*Id.*, col. 3:27-31) However, polyesters have inferior gas-barrier properties. Because they are not impervious to gas, they limit the shelf life of oxygen-sensitive foods, condiments, and beverages (such as juice, soda, or beer). (*Id.*, col. 1:27-33)

In the prior art, it was known that the use of low-gas permeable polymers, known as partially aromatic polyamides (or “nylons”), with polyesters increases barrier properties. (*Id.*, col. 1:31-38) Partially aromatic polyamides have non-scavenging, or “passive,” barrier properties – they restrict carbon dioxide leakage from, and oxygen intrusion into, a container by obstructing the paths of gas molecules. (*Id.*, col. 1:21; ‘930 patent, col. 2:22) However, partially aromatic polyamides are not miscible – they do not mix well – with polyesters like PET, and they also give containers an undesirable yellow and hazy appearance. (‘216 patent, col. 1:44-46)

It was commonly known in the art that combining a thin layer of a partially aromatic polyamide, like MXD6,³ with one or more layers of polyester in multilayer bottles increased barrier properties. (*Id.*, col. 1:35-43; ‘930 patent, col. 2:18-25) This multilayer system, however, produced bottles with undesirable haze. (‘216 patent, col.

³MXD6 is the commercial name for poly(meta-xylylene adipamide). (‘930 patent, col. 1:50-51)

1:33-35)

It was also known in the art that the addition of a transition metal catalyst, such as cobalt salt, improved the gas barrier properties of polyamide multilayer containers and blends with PET by promoting active oxygen scavenging. (*Id.*, col. 2:32-48; '930 patent, col. 1:30-31, 1:51-5-55) As opposed to a passive barrier, this "active" barrier reacts with oxygen in the process of traversing the package barrier. ('930 patent, col. 1:33-38)

B. The Inventions and Patents-in-Suit

1. The '159 and '216 patents⁴

According to the patentee, no prior art disclosed a monolayer container with a desirable balance of high gas barrier properties and low yellowness and haze. ('216 patent, col. 2:55-61) The '159 and '216 patents teach compositions with increased gas barrier properties that can be used in monolayer containers and have reduced yellowness and haze. (*Id.*, col. 2:55-61; 2:65-3:13) The inventions are useful has packaging for oxygen-sensitive foods that require a long shelf life. (*Id.*, col. 2:55-67)

The '159 patent discloses a four-component composition. Claim 1 of the '159 patent provides:

1. A composition for containers comprising: polyester, partially aromatic polyamide, ionic compatibilizer, and a cobalt salt; wherein said ionic compatibilizer is a copolyester containing a metal sulfonate salt.

As discussed, the partially aromatic polyamide provides a passive barrier. The cobalt salt is a transition metal catalyst that "activates" the partially aromatic polyamide to form

⁴Invista is asserting infringement of claims 1-5, 8, 9, and 12 of the '216 patent and claims 1-6, 9, 10, 13-18, 21, and 22 of the '159 patent.

an active barrier that scavenges oxygen, thereby improving barrier properties. The patentee reports that the ionic compatibilizer allows a “synergistic reduction” in yellowness and haze and “surprisingly” increases barrier properties even further. ('159 patent, col. 5:22-25, 9:58-61)

The '216 patent is a division of the '159 patent and shares the same specification. (See '216 patent, col. 1:8-9) The '216 patent discloses a three-component composition. Claim 1 of the '216 patent recites:

1. A composition for containers comprising:
 - a copolyester comprising a metal sulfonate salt;
 - a partially aromatic polyamide;
 - and a cobalt salt.

The composition of the '216 patent differs from that of the '159 patent in that it replaces the polyester and ionic compatibilizer components and recites, in their place, “a copolyester comprising a metal sulfonate salt.” The other claims of the '216 and '159 patents recite more specific compositions, as well as articles and containers made from the compositions.

2. The '930 patent⁵

Invista is also asserting indirect infringement of claims 1, 3-6, 8, 10, and 11 of the '930 patent, which relates to colored oxygen scavenging polymers and articles made from such polymers, such as green, blue, or amber bottles. ('930 patent, col. 1:7-8, 2:20) In the prior art, it was not problematic to use colorants because there would be

⁵Invista is asserting claims infringement of claims 1, 3-6, 8, 10, and 11 of the '930 patent.

no reaction between the colorant, which was added to the non-scavenging (or passive barrier) layers and the transition metal catalyst, which was contained in the oxygen scavenging (or active barrier) layer. (*Id.*, col. 2:20-25) However, in monolayer articles, such as those taught in the '159 and '216 patents, the colorant is intimately mixed in a melt phase with the transition metal catalyst. (*Id.*, col. 2:35-38) Some colorants deactivate the transition metal catalyst after melt blending, which makes the transition metal catalyst less effective as a catalyst. (*Id.*, col. 2:32-34)

The '930 patent relates to the use of certain colorants that do not completely deactivate the catalyst and, thus, are suitable for use with a transition metal catalyst in monolayer scavenging systems. (*Id.*, col. 2:42-44) The specification of the '930 patent describes the methods used to determine the catalyst deactivation properties of colorants. The oxygen permeability of each specimen was measured at zero percent relative humidity, one atmosphere pressure, and 23° C, and was expressed in the units (cc(STP) cm)/(m² atm day). (*Id.*, col. 6:58-59) Then the catalyst deactivation factor ("CDF") was defined as: "(oxygen permeability of base polymer, oxidizable organic polymer, transition metal catalyst and 0.25 weight % colorant) / (oxygen permeability of base polymer and oxidizable organic polymer)." (*Id.*, col. 6:59-64) In other words, the CDF is the oxygen permeability of the activated polymer blend with 0.25 weight % colorant, expressed as a fraction of the oxygen permeability of the passive polymer blend without any colorant. A CDF of 1 corresponds to complete deactivation (such that the composition containing the active barrier and colorant has the same oxygen permeability as the passive barrier), whereas a CDF of 0 corresponds to no

deactivation of the oxidation catalyst. (*Id.*, col. 6:65-67)

The '930 patent claims a melt blended resin, monolayer film, or article comprising a base polymer, an oxidizable organic polymer, a transition metal catalyst, and a colorant. (*Id.*, col. 2:44-63) The colorant of the claimed invention has a CDF of less than about 0.25, preferably less than 0.15, more preferably less than 0.1, and most preferably less than 0.05. (*Id.*, abstract, col. 8:2-4) The blend may also optionally include a compatibilizer and other additives. (*Id.*, col. 2:47-48, 5:33-44) There is one independent claim among the asserted claims of the '930 patent:

1. A melted blended resin for packaging articles comprising:

a base polymer;
oxidizable organic polymer;
transition metal catalyst; and
a colorant;

such that an article made from said melt blended resin has a catalyst deactivation factor of less than 0.25, and further wherein said base polymer is selected from the group consisting of polyethylene, polyester, polyvinyl chloride, polyvinylidene chloride, ethylene copolymers, and blends thereof.

III. STANDARD OF REVIEW

Claim construction is a matter of law. *Phillips v. AWH Corp.*, 415 F.3d 1303, 1330 (Fed. Cir. 2005) (en banc). Claim construction focuses on intrinsic evidence – the claims, specification and prosecution history – because intrinsic evidence is “the most significant source of the legally operative meaning of disputed claim language.”

Vitronics Corp. v. Conceptronic, Inc., 90 F.3d 1576, 1582 (Fed. Cir. 1996); *Markman v.*

Westview Instruments, Inc., 52 F.3d 967, 979 (Fed. Cir. 1995) (en banc), *aff'd*, 517 U.S. 370 (1996). Claims must be interpreted from the perspective of one of ordinary skill in the relevant art at the time of the invention. *Phillips*, 415 F.3d at 1313.

Claim construction starts with the claims, *id.* at 1312, and remains centered on the words of the claims throughout. *Interactive Gift Express, Inc. v. Compuserve, Inc.*, 256 F.3d 1323, 1331 (Fed. Cir. 2001). In the absence of an express intent to impart different meaning to claim limitations, the limitations are presumed to have their ordinary meaning. *Id.* Claims, however, must be read in view of the specification and prosecution history. Indeed, the specification is often "the single best guide to the meaning of a disputed term." *Phillips*, 415 F.3d at 1315.

IV. DISCUSSION⁶

Invista proposes the plain and ordinary meaning for all of the disputed limitations of the patents-in-suit and, to the extent the court finds construction necessary, offers constructions for some of them. (D.I. 209) M&G cites to the patent specifications and the prosecution histories for narrower constructions of all of the disputed limitations.⁷

⁶The court reserves the right to supplement or revise claim construction during trial.

⁷M&G seeks to strike the expert testimony of Dr. Edward E. Paschke, which was submitted by Invista with its opening claim construction brief on February 20, 2013, just hours before the close of expert discovery. (D.I. 228; see D.I. 212, ex. F) Invista avers that Dr. Paschke's testimony merely provides the court with a background tutorial for purposes of claim construction and that his opinions fall outside the scope of the scheduling order, which required only the exchange of expert reports "on issues for which the parties have the burden of proof," i.e. infringement and invalidity. (D.I. 260 at 3, 7) (citing D.I. 18 at ¶ 2(d); D.I. 229, ex. B)

However, Dr. Paschke opines, in part, on how a person of ordinary skill in the art would understand the disputed terms "copolyster comprising a metal sulfonate salt," "metal sulfonate salt," "attached," and "copolyster containing a metal sulfonate salt."

(*Id.*)

A. The Disputed Limitations of the '216 and '159 Patents⁸

1. "Composition"

As a threshold matter, the parties dispute whether the term "composition" needs to be construed. "Composition" appears in the preamble of claim 1 in both the '159 and '216 patents: "A composition for containers comprising:" It also appears in independent claim 13 of the '159 patent:

13. An article comprising a composition comprising polyester, partially aromatic polyamide, ionic compatibilizer, and a cobalt salt.

Otherwise, "composition" only appears in dependent claims, wherein the claim references "the composition of" another claim. For example, claim 12 of the '216 patent recites:

(D.I. 212, ex. F at ¶¶ 9-15) Claim construction is an issue highly relevant to infringement in this case. Even if Invista's filing of new expert testimony at the close of expert discovery and without prior notice to M&G did not technically violate the scheduling order, it was inconsistent with the intent of the scheduling order. See *Bioavail Labs. Int'l SRL v. Cary Pharms. Inc.*, Civ. No. 09-605, 2010 WL 2132021, at *3 (D. Del. May 26, 2010) (finding that, although plaintiff did not technically violate a truncated scheduling order, its filing of a rebuttal expert declaration, when defendant believed the record with respect to claim construction experts was complete, was "inconsistent with the intent of the Scheduling Order").

Dr. Paschke did not previously produce an expert report in this case, and M&G has not had an opportunity to depose him about his opinions. While Invista correctly asserts that expert testimony can aid the court in claim construction, allowing new expert testimony that has not been vetted through discovery would unduly prejudice M&G. Therefore, the court does not consider Dr. Paschke's expert testimony and grants M&G's motion to strike it. (D.I. 228) M&G's request for costs and fees for making the motion is denied. (*Id.*)

⁸Unless otherwise noted, each disputed limitation of the '216 and '159 patents appears in both patents, and the parties agree the same construction should apply. (See D.I. 209)

12. An article comprising the composition of any one of claims 1-11; wherein said article is a preform or a container.

Invista avers that “composition” is not limiting because it only appears in the preamble of the claims and does not lend structure to the claims. (D.I. 211 at 7-9) M&G argues that the term “composition” does not always appear in a preamble; for instance, it appears after the first instance of “comprising” in claim 13 of the ‘159 patent and after the transitional word “comprising” in claim 12 of the ‘216 patent. (D.I. 230 at 11 n.1) And even if it did always appear in a preamble, M&G asserts, the term must be construed because it describes the statutory subject matter of the inventions. (D.I. 252 at 3-4)

“If the body of the claim ‘sets out the complete invention,’ the preamble is not ordinarily treated as limiting the scope of the claim.” *Bicon, Inc. v. Straumann Co.*, 441 F.3d 945, 952 (quoting *Schumer v. Labs. Computer Sys., Inc.*, 308 F.3d 1304, 1310 (Fed. Cir. 2002)). However, the preamble may be limiting when it recites essential structure that is important to the invention or necessary to give meaning to the claim.

NTP, Inc. v. Research In Motion, Ltd., 418 F.3d 1282, 1305-06 (Fed. Cir. 2005), *cert. denied*, 546 U.S. 1157 (2006). “In other words, when the claim drafter chooses to use **both** the preamble and the body to define the subject matter of the claimed invention, the invention so defined, and not some other, is the one the patent protects.” *Bell Commc'n Research, Inc. v. Vitalink Commc'n Corp.*, 55 F.3d 615, 620 (Fed. Cir. 1995). “Whether a preamble stating the purpose and context of the invention constitutes a limitation . . . is determined on the facts of each case in light of the overall form of the claim, and the invention as described in the specification and illuminated in

the prosecution history.” *Applied Materials, Inc. v. Advanced Semiconductor Materials Am., Inc.*, 98 F.3d 1563, 1572-73 (Fed. Cir. 1996); see also *In re Stencil*, 828 F.2d 751, 754 (Fed. Cir. 1987).

“Composition” gives meaning and vitality to the claims – without it, claim 1 of the ‘159 and ‘216 patents merely list components, without any structure that describes how they are interrelated. Moreover, dependent claims 2-12 of the ‘159 patent and dependent claims 2-11 of the ‘216 patent refer to said “composition” and modify it. “[W]hen the limitations in the body of the claim ‘rely upon and derive antecedent basis from the preamble, then the preamble may act as a necessary component of the claimed invention.” *Bicon*, 441 F.3d at 952 (quoting *Eaton Corp. v. Rockwell Int'l Corp.*, 323 F.3d 1332, 1339 (Fed. Cir. 2003)). In addition, “composition” appears in independent claim 13 of the ‘159 patent following the first instance of “comprising,” indicating that the claimed article includes within it a “composition” as an essential component which, in turn, is comprised of individual ingredients. The term “composition” also appears after the only transitional phrase in claim 12 of the ‘216 patent, indicating that it is a limitation of that claim. To read claim 12 otherwise would read out its subject matter, as the only limitation remaining would be that the named article “is a preform or a container.” Therefore, given that the “composition” term supplies necessary structure, serves as an antecedent for many dependent claims, and appears as a non-preamble limitation in some independent claims, the court finds that it should be interpreted as a claim limitation.

M&G proposes that “composition” must be “a blend of two or more ingredients that exist together at the same time.” (D.I. 209) Invista disputes that a “composition”

has to be a blend and that the ingredients must exist together at the same time.⁹ (D.I. 211 at 9-10)

The specification of the '159 and '216 patents repeatedly and only refers to the claimed composition as a "blend." (See, e.g., '216 patent, abstract, col. 1:17, 1:21, 1:33, 3:2, 4:51, 5:40, 5:55-58) Even the broadest portions of the specification refer to the composition as a blend. For instance, the abstract refers to the invention as comprising a "blend of polyester and a partially aromatic polyamide with an ionic compatibilizer and a cobalt salt." (*Id.*, abstract) Similarly, the background section states that the invention relates to "**blends** of polyamides in polyesters, a method for forming **such compositions**, and . . . containers made from **such compositions**." (*Id.*, col. 1:17-19) (emphasis added) Moreover, the specification explicitly states: "**In the broadest sense** the present invention comprises a compatibilized **blend** of polyester and a partially aromatic polyamide with an ionic compatibilizer and a cobalt salt." (*Id.*, col. 3:1-3) (emphasis added) Although the specification of the '216 and '159 patents describes different methods for preparing blends of the claimed ingredients, the blend does not exist until all of the ingredients have been mixed together. (*Id.*, col. 5:40-58) Therefore, the patentee set the outer boundaries of the invention as "blends," or the ingredients after they are mixed together.

This construction is consistent with the Federal Circuit's construction of the plain and ordinary meaning of "composition" in the field of chemistry. The Federal Circuit has

⁹In its claim construction briefing and at the *Markman* hearing, Invista proffered that the plain and ordinary meaning of composition is the "sum of the components." (D.I. 211 at 9-11; D.I. 248 at 3; D.I. 368 at 28:22-29:3)

found that a chemical “composition” is well-established as a term of art in both chemistry and patent law to be a mixture of substances, not simply the ingredients before they are mixed. In *Exxon Chemical Patents, Inc. v. Lubrizol Corp.*, 64 F.3d 1553 (Fed. Cir. 1995), the Federal Circuit held that “[t]he chemical composition exists at the moment the ingredients are mixed together. Before creation of the mixture, the ingredients exist independently.” *Id.* at 1558. The Court noted that the term “composition” had no temporal limitation; a composition could exist at any time during a preparation or manufacturing process. *Id.*

Subsequently, the Court in *PIN/NIP, Inc. v. Platte Chemical Co.*, 304 F.3d 1235 (Fed. Cir. 2002), adopted the construction from *Exxon* as the “basic definition” of “composition,” with the caveat that claim construction remains a highly contextual exercise:

The term ‘composition’ in chemistry is well-established. It generally refers to mixtures of substances. . . . **Although the construction of a term in a patent claim is a highly contextual exercise that is dependent upon the content of the particular patent in which the term appears, and one cannot always apply the construction of a claim term from one patent to an unrelated patent in an unrelated lawsuit**, the basic definition of the term “composition” is well-established, was well-expressed in *Exxon*, and is applicable to this case.

Id. at 1244 (emphasis added). The Court again commented on the construction of the term “composition” in *Mars, Inc. v. H.J. Heinz Co.*, 377 F.3d 1369 (Fed. Cir. 2004):

In [PIN/NIP and Exxon] “we equated a composition with a mixture” and construed the term “composition” to refer to the claimed ingredients **after** they were joined together. . . . The specification does not, as [defendant] contends, provide a basis for deviating from this ordinary meaning.¹⁰

¹⁰Although *Exxon*, *PIN/NIP*, and *Mars* are all pre-*Phillips* (2005) cases, their discussion of “composition” is consistent with *Phillips*’ principles of claim construction.

Id. at 1374.

District court cases have used *Exxon* as support for arriving at equivalent constructions of “composition.” See, e.g., *Kim v. Conagra Foods, Inc.*, Civ. No. 01 C 2467, 2003 WL 21222266, at *7 (N.D. Ill. May 23, 2003) (recognizing the *Exxon* Court’s understanding of the term “composition” as “a term of art in both chemistry and patent law” and engaging in an independent claim construction exercise to arrive at a consistent construction); *Kim v. Earthgrains Co.*, Civ. No. 01 C 3895, 2005 WL 66071, at *11 (N.D. Ill. Jan. 11, 2005) (finding that, in the context of the patent that was at issue, “composition” had its ordinary and customary meaning, consistent with the *Exxon* Court’s construction of the term); *Ultradent Products, Inc. v. Life-Like Cosmetics, Inc.*, 924 F. Supp. 1101, 1108-10, 1114 (D. Utah 1996) (relying on *Exxon* for composition claims). Courts have declined to adopt the *Exxon* definition of “composition” when doing so would be inconsistent with the patent-in-suit. For example, in *Allergan, Inc. v. Sandoz Inc.*, Civ. No. 6:11-cv-441, 2013 WL 139350, at *4-5 (E.D. Tex. Jan. 10, 2013), the Eastern District of Texas found that the *Exxon* Court’s definition would run counter to the entirety of the claim language of the patent-at-issue. The composition of the invention included citric acid monohydrate, which a person of ordinary skill in the art would understand dissolves into an aqueous solution and would not be present (in that form) in a mixture. Therefore, rather than applying the *Exxon* construction of “composition,” the court found the Federal Circuit’s construction of “solutions” to be more applicable: “the ingredients used to make the solution.” *Id.* at *5 (citing *Norian Corp. v. Stryker Corp.*, 432 F.3d 1356, 1362 (Fed. Cir. 2005)). The court declined to

apply *Exxon* and concluded that the claims only required citric acid monohydrate as a beginning ingredient. *Id.*; see also *Idexx Labs, Inc. v. Abaxis, Inc.*, 222 F. Supp. 2d 66, 70 (D. Me. 2002) (finding that *Exxon* does not preclude a specified ingredient from being dissolved in a liquid solution).

In the instant case, the court finds no reason to deviate from the *Exxon* Court's construction of "composition." The intrinsic evidence indicates that a "composition" must be a "blend" of ingredients, and neither party avers it would not be possible for those ingredients to exist together in a mixture.

To the extent M&G proposes an additional temporal limitation, the court finds that, like in *Exxon*, there is no intrinsic evidence to support such a limitation. See *Exxon*, 64 F.3d at 1558. The "composition" may exist at any time during or after the manufacturing process, as long as the ingredients have been mixed together. Therefore, the court construes "composition" to mean "a blend that contains the specified ingredients at any time from the moment the ingredients are mixed together."

2. "Ionic compatibilizer" ('159 patent)

The term "ionic compatibilizer" is a claim limitation only in the '159 patent. It does not appear in the claim language of the '216 patent. M&G proposes that "ionic compatibilizer" be construed as "a copolyester containing a metal sulfonate salt." (D.I. 209) Invista avers that the limitation should be given its plain and ordinary meaning or, if a construction is necessary, the meaning "a copolyester with an ionic compatibilizing group." (*Id.*)

The specification teaches that "[t]he ionic compatibilizer is preferably a

copolyester containing a metal sulfonate salt group" ('159 patent, col. 4:62-63) and does not describe it in any other form. Moreover, "ionic compatibilizer" is expressly defined in claim 1 of the '159 patent as a "copolyester containing a metal sulfonate salt." Where "ionic compatibilizer" is recited in other independent claims of the '159 patent, that same definition appears within the language of the claim. (See *id.*, claims 13, 25, 27) Therefore, the court construes "ionic compatibilizer" in accordance with the specification and the explicit definition provided by the claims of the '159 patent to mean a "copolyester containing a metal sulfonate salt."

3. "Copolyester containing a metal sulfonate salt" ('159 patent)

The parties disagree as to what the phrase "copolyester containing a metal sulfonate salt" means. This term appears only in the claims of the '159 patent, not the '216 patent, and always with the "ionic compatibilizer" limitation. M&G proposes the construction "a copolyester wherein one of the diacid monomer links is a sulfomonomer; wherein a metal sulfonate salt is attached to the sulfomonomer; and wherein the metal sulfonate salt is attached to the copolyester." (D.I. 209) Invista proposes the plain and ordinary meaning and, to the extent a construction is necessary, "a copolyester including, but not limited to, a metal sulfonate salt group." (*Id.*)

The court begins with the well-established principle that "containing" is generally an open-ended term that is synonymous with "comprising" or "including" and does not exclude additional, unrecited elements. See *Mars*, 377 F.3d at 1375-76; see also MPEP § 2111.03. Although a "patentee [may choose] to be his own lexicographer and use . . . terms in a manner other than their ordinary meaning," *Bell Atlantic Network*

Servs., Inc. v. Conrad Commc'nns Grp., Inc., 262 F.3d 1258, 1268 (Fed. Cir. 2001), “[i]n redefining the meaning of particular claim terms away from their ordinary meaning, the intrinsic evidence must ‘clearly set forth’ or ‘clearly redefine’ a claim term so as to put one reasonably skilled in the art on notice that the patentee intended to so redefine the claim term.” *Id.* (quoting *Elektra Instrument S.A. v. O.U.R. Scientific Int'l Inc.*, 214 F.3d 1302, 1307 (Fed. Cir. 2000)). Therefore, to limit the scope of “copolyester containing a metal sulfonate salt” to require that the copolyester not merely include a metal sulfonate salt, but that the two are “attached” to each other, would require that the patentee clearly set forth such a narrowing definition.

The written description teaches that the metal sulfonate salt is attached to the aromatic acid nucleus of a sulfomonomer, which the parties seem to agree is, in turn, incorporated into the copolyester. (‘159 patent, col. 4:62-63, 4:65-67, 5:4; D.I. 211 at 18, 22; D.I. 230 at 17) In other words, the metal sulfonate salt, by its attachment to the aromatic acid nucleus, is a part of the copolyester.¹¹ That the metal sulfonate salt is ultimately a part of the copolyester is also reflected in the claim language of the ‘159 patent, which equates a “copolyester containing a metal sulfonate salt” to a single component, the “ionic compatibilizer,” of the claimed composition. (See, e.g., ‘159 patent, claim 1)

The parties agree that the metal sulfonate salt is included in the copolyester

¹¹This view is consistent with the prosecution history of the ‘216 patent, in which the patentee explained that a person of skill in the art would know the arrangement of the metal sulfonate salt. The patentee gave, as an example: “[W]hen the aromatic acid nucleus is 5-sulfoisophthalic acid . . . and the metal is sodium, the sodium sulfonate salt is attached to the aromatic ring” (D.I. 213 at JA126-27)

through its attachment to the aromatic acid nucleus; however, Invista objects to M&G's construction as redundant, arguing that, "if the metal sulfonate salt group is attached to the sulfomonomer, it is necessarily attached to the copolyester." (See D.I. 211 at 22) The court finds that it is sufficient to specify that the copolyester must include a metal sulfonate salt. Whether or not the metal sulfonate salt, via its direct attachment to the aromatic acid nucleus of the sulfomonomer, can also be said to be "attached" to the copolyester is immaterial. To require, as M&G proposes, that the metal sulfonate salt is not only attached to the aromatic acid nucleus but also to the copolyester would be confusing. Therefore, the court adopts Invista's construction. The court construes "copolyester containing a metal sulfonate salt" to mean "a copolyester including, but not limited to, a metal sulfonate salt."

4. "**Copolyester comprising a metal sulfonate salt**" ('216 patent)

Instead of using the term "copolyester **containing** a metal sulfonate salt," claim 1 of the '216 patent recites a "copolyester **comprising** a metal sulfonate salt." (Emphasis added) This difference in wording (comprising vs. containing) is the source of the claim construction dispute regarding the "copolyester comprising a metal sulfonate salt" limitation of the '216 patent. Like its proposed construction for "copolyester containing a metal sulfonate salt," M&G again proposes that the metal sulfonate salt must be attached to the aromatic acid nucleus of a sulfomonomer of the copolyester. However, based on a single statement made during prosecution history, M&G avers that a "copolyester comprising a metal sulfonate salt" (unlike a "copolyester containing a metal sulfonate salt") means the metal sulfonate salt is **not** attached to the copolyester,

specifically: "a copolyester wherein one of the diacid monomer links is a sulfomonomer; wherein a metal sulfonate salt is attached to the sulfomonomer; and wherein the metal sulfonate salt is not attached to the copolyester." (D.I. 209; D.I. 230 at 17, 21) Invista, on the other hand, avers that "comprising," like "containing," is an open-ended term. (D.I. 211 at 13-14, 22) To the extent the court decides the term requires construction, Invista proposes the same construction for "copolyester comprising a metal sulfonate salt" as for "copolyester containing a metal sulfonate salt;" "a copolyester including, but not limited to, a metal sulfonate salt group." (D.I. 209)

Therefore, as M&G recognizes, to require that the metal sulfonate salt is attached to the sulfonomer but not attached to the copolyester would be nonsensical as internally contradictory – the metal sulfonate salt cannot be attached to a monomer link of the copolyester yet be entirely separate from the copolyester at the same time.¹² (See D.I. 252 at 9-10) Such a nonsensical construction would render the '216 patent claims inoperable. It is true, as M&G asserts, that, "where . . . claims are susceptible to only one reasonable interpretation and that interpretation results in a nonsensical construction of the claim as a whole, the claim must be invalidated." *Chef Am., Inc. v. Lamb-Weston, Inc.*, 358 F.3d 1371, 1374 (Fed. Cir. 2004) (citation omitted) (internal quotation marks omitted). However, the term at issue is distinguishable because M&G's proposed construction is not the only reasonable interpretation.

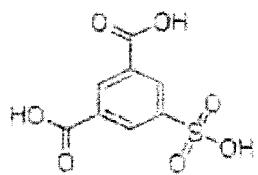
M&G's proposed construction relies on a single statement that the patentee

¹²Even if M&G's proposed construction is directed at requiring the sulfomonomer to be free-floating in the composition, such a result would be contrary to the teaching of the specification, as discussed *infra*.

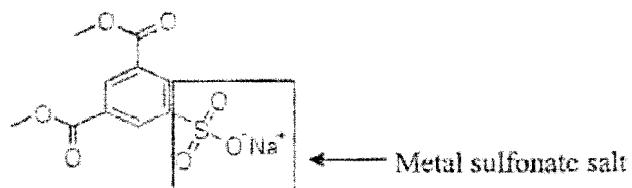
made during prosecution of the '216 patent, in response to a question posed by the examiner in a rejection for indefiniteness. The patentee amended the language of claim 31 (which later issued as claim 1) from "**containing** a metal sulfonate salt" to "**comprising** a metal sulfonate salt." The patentee stated that the amendment was made to "negate any confusion as to whether or not the metal sulfonate salt is attached. **For the record, the metal sulfonate salt is not attached to the copolyester.**" (D.I. 213 at JA121, JA126-27) (emphasis added)

However, the full prosecution history shows that the metal sulfonate salt is still attached to the aromatic acid nucleus of the sulfomonomer. In the same rejection, the examiner stated that, in pending claim 39 (which later issued as claim 9), it was unclear how the metal sulfonate salt is attached to the aromatic acid nucleus. (*Id.* at JA104) The patentee's response demonstrates that the metal sulfonate salt is still attached to the aromatic acid nucleus of the copolyester:

A person of skill in the art would know the arrangement of the metal sulfonate salt based on the claim as written and the specification. Specifically, the metal sulfonate salt is attached to the aromatic ring of the respective sulfonic acid. For example, when the aromatic acid nucleus is 5-sulfoisophthalic acid (see structure below) and the metal is sodium, the sodium sulfonate salt is attached to the aromatic ring (see structure below). This is all common knowledge to those of skill in the art.



5-Sulfoisophthalic acid



sodium dimethyl 5-sulphonatoisophthalate

(*Id.* at JA126-27)

Moreover, during prosecution, the examiner and the patentee both understood the '216 patent to be directed at a three-component system, i.e., the four-component system of the '159 patent without the "polyester" component. (*Id.* at JA103, JA124-25) The specification provides examples of the three-component system, all of which teach that the "copolyester comprising a metal sulfonate salt" component is made by "melt phase polymerization . . . conducted in the normal way . . ." (See, e.g., '216 patent, col. 8:39-46, 9:9-10:21, 5:51) In other words, the metal sulfonate salt is polymerized with the copolyester in each of those embodiments. None of the embodiments teach the metal sulfonate salt or sulfomonomer being completely unattached from the polyester such that it is freely roaming in the mixture. The specification of the '216 patent, identical to that of the '159 patent, teaches only one way that the metal sulfonate salt is related to the copolyester – it is attached to the aromatic acid nucleus of a sulfomonomer, which, in turn, is part of the copolyester. (*Id.*, col. 4:67-5:2, 5:6)

A claim construction that excludes preferred embodiments described in the specification "is rarely, if ever, correct and would require highly persuasive evidentiary support" to be adopted. *Vitronics*, 90 F.3d at 1583. M&G's construction, which would render the copolyester and metal sulfonate salt to be separately existing components, would eliminate all of the embodiments, including the preferred embodiments, described in the specification's examples. It would also destroy the three-component system described in the claim language and prosecution history. Therefore, considering all of the intrinsic evidence, the court finds that the only reasonable interpretation of the statement in prosecution history on which M&G relies is that the

patentee meant the metal sulfonate salt is not **directly** attached to the copolyester.

See *Ecolab, Inc. v. FMC Corp.*, 569 F.3d 1335, 1342 (Fed. Cir. 2009) (“Even if an isolated statement appears to disclaim subject matter, the prosecution history as a whole may demonstrate that the patentee committed no clear and unmistakable disclaimer.”). In light of the full prosecution history, that single statement was not a clear and unequivocal disclaimer that warrants reading out every embodiment of the ‘216 patent.

In addition, “comprising” is generally an open-ended term and is synonymous with “containing.” See *Mars*, 377 F.3d at 1375-76; see also MPEP § 2111.03 (“The transitional term ‘comprising’ . . . is synonymous with ‘including,’ ‘containing,’ or ‘characterized by,’ is inclusive or open-ended and does not exclude additional, unrecited elements or method steps.”). The court does not find that the patentee clearly redefined the broad term “comprising.” *Bell Atlantic*, 262 F.3d at 1268 (“In redefining the meaning of particular claim terms away from their ordinary meaning, the intrinsic evidence must ‘clearly set forth’ or ‘clearly redefine’ a claim term so as to put one reasonably skilled in the art on notice that the patentee intended to so redefine the claim term.” (Citation omitted)). Although the patentee clarified during prosecution that the metal sulfonate salt is not directly attached to the copolyester, it is consistent for “comprising” to still mean that the metal sulfonate salt is included in the copolyester. For the foregoing reasons, the court adopts the same construction for a “copolyester comprising a metal sulfonate salt” as it does for “copolyester containing a metal sulfonate salt.” A “copolyester comprising a metal sulfonate salt” is “a copolyester

including, but not limited to, a metal sulfonate salt.”

5. “Polyester” (‘159 patent)

Like “ionic compatibilizer,” “polyester” only appears as a claim limitation in the ‘159 patent; it does not appear in any claim of the ‘216 patent. M&G proposes that a “polyester” is “a resin made from chains of monomer links; wherein individual chains are made from chaining together diacid monomer links with diol monomer links and the resin does not contain an ionic compatibilizer.” (D.I. 209) During the *Markman* hearing, Invista did not dispute the first half of M&G’s proposed construction (“a resin made from chains of monomer links; wherein individual chains are made from chaining together diacid monomer links with diol monomer links . . .”), except to add that the individual chains may also be made from chaining together diester monomer links with diol monomer links. (D.I. 368 at 38:25-40:18) The court agrees with Invista in this regard,¹³ as the specification teaches that polyesters can be prepared by one of two processes, either the ester process or the acid process. (‘159 patent, col. 3:24-25) In the former, a diester is reacted with a diol and, in the latter, a diacid is reacted with a diol. (*Id.*, col. 3:26-28, 3:41-44) This understanding comports with the general definition of “polyester resin.” See *McGraw-Hill Dictionary of Scientific and Technical Terms* (6th ed. 2003) (“A thermosetting or thermoplastic synthetic resin made by esterification of polybasic organic acids with polyhydric acids”); Richard J. Lewis, Sr., *Hawley’s Condensed Chemical Dictionary* (13th ed. 1997) (“Any of a group of synthetic resins, which are polycondensation products of dicarboxylic acids with dihydroxy alcohols.”).

¹³During the *Markman* hearing, M&G also seemed to agree with Invista in this regard. (See D.I. 368 at 47:5-12)

The core of the dispute regarding the “polyester” limitation is whether, as M&G contends, it must not contain an ionic compatibilizer (or “copolyester containing a metal sulfonate salt”).¹⁴ This portion of M&G’s proposed construction is narrower than the plain and ordinary meaning to one of ordinary skill in the art because the general meaning of polyester includes all copolyester, a subclass of polyesters. (See D.I. 247 at 8; D.I. 252 at 10) M&G asserts that this narrower construction, however, is warranted because the patentee distinguished between “polyester” and “copolyester containing a metal sulfonate salt” in the claims and in the prosecution history. (D.I. 230 at 11-14) M&G argues that “polyester” and “copolyester containing a metal sulfonate salt” (or “ionic compatibilizer”) must be mutually exclusive, or else the two terms would “collapse together” and “read out” the “ionic compatibilizer” as a limitation. (*Id.*)

“Polyester” and “ionic compatibilizer” are separate limitations in the claims of the ‘159 patent. While preserving claim integrity does not require that two terms in a claim necessarily refer to two different components (just that they connote different meanings), “[t]he prosecution history, specification, comparison with other claims in the patent, and other evidence **may require that two terms in a claim refer to different [components].**” *Applied Med. Res. Corp. v. U.S. Surgical Corp.*, 448 F.3d 1324, 1333 n.3 (Fed. Cir. 2006) (emphasis added). When viewed in light of the prosecution history, the patentee explicitly required that the “polyester” and “ionic compatibilizer” limitations refer to different components, such that the claimed invention is a four-component system.

¹⁴As construed by the court, *supra*, the “ionic compatibilizer” limitation of the ‘159 patent is synonymous with “copolyester containing a metal sulfonate salt.”

During prosecution of the '159 patent, the examiner rejected claims 1, 14, and 28¹⁵ for being indefinite and posed the following to the patentee: "It is unclear if or how the generic 'polyester' component distinguishes over the 'copolyester containing a metal sulfonate salt.' Are these the same or different polyester components?" (D.I. 213 at JA 417, JA446) In response, the patentees clarified the significance of the separate recitation of "polyester" and "copolyester containing a metal sulfonate salt:"

Applicants traverse this rejection and submit that any skilled artisan would realize that a separate recitation of "polyester" and "copolyester containing a metal sulfonate salt" **within the same list of ingredients would necessarily mean the components are different**. Claims must be read in light of the specification, and throughout the specification, it is quite clear that the "ionic compatibilizer" component of the composition does not refer to "polyester" recited as the first component of the composition. Misconstruction of the claims resulting in **giving the same meaning to clearly different phrases within the same claims** results in violation of the holding of the Federal Circuit Court of Appeals in *Ethicon Endo-Surgery v. United States*, 9[3] F.3d 1572, 1579 (Fed. Cir. 1996).

(*Id.* at JA463-64) (first emphasis added) This statement clarifies that "polyester" and "copolyester containing a metal sulfonate salt" (or "ionic compatibilizer"), as used in the '159 patent, are "necessarily . . . different" components of the invention. In other words, the patentee disclaimed the possibility that the "ionic compatibilizer" component could be subsumed in the "polyester" component of the invention.

The court recognizes that the specification of the '159 patent teaches several methods of preparing the composition of the invention, including two methods that appear to permit the polyester and ionic compatibilizer to form a new copolyester before being combined with a transition metal catalyst and partially aromatic polyamide. ('159

¹⁵Claim 14 eventually issued as claim 13, and the limitations of claim 28 were incorporated into claims 25 and 27, as issued.

patent, col. 5:39-53) A third method calls for the components to simply be blended together or as a blend of master batches. (*Id.*, col. 5:54-55) The claims of the '159 patent, as written and explicitly clarified by the patentee to traverse a rejection during prosecution, teach a four-component composition, wherein the "polyester" and "ionic compatibilizer" components are separate and distinct. Therefore, to the extent the first two methods of preparation result in a three-component composition, they are not literally encompassed by the claims of the '159 patent.¹⁶ See *TIP Sys., LLC v. Phillips & Brooks/Gladwin, Inc.*, 529 F.3d 1364, 1373 (Fed. Cir. 2008) ("[R]ead in the context of the specification, the claims of the patent need not encompass all disclosed embodiments.").

For the foregoing reasons, the court construes "polyester," for purposes of the '159 patent, to mean "a resin made from chains of monomer links; wherein individual chains are made from chaining together diacid or diester monomer links with diol monomer links and the resin is not an ionic compatibilizer."¹⁷

6. "Attached"

The disputed term "attached" is recited in claims 10 and 22 of the '159 patent and claim 9 of the '216 patent in the context of a "metal sulfonate salt" being "attached to an aromatic acid nucleus." M&G avers that "attached" means "covalently bonded,"

¹⁶As discussed *infra*, the claims of the '216 patent, which was filed as a divisional, are directed at a three-component composition.

¹⁷To avoid confusion with the court's construction of "copolyester **containing** a metal sulfonate salt," the court defines the "polyester" limitation of the '159 patent using "the resin **is not** an ionic compatibilizer," rather than M&G's proposed phrasing "the resin **does not contain** an ionic compatibilizer."

such that it excludes all other types of attachment or bonding. (D.I. 230 at 20-21)

Invista avers that nothing in the patent claims or specification limits “attached” to a particular type of attachment or bonding.¹⁸ (D.I. 211 at 20)

The specification of the ‘216 and ‘159 patents never limits the method of attachment. (‘216 patent, col. 4:67-5:1) During prosecution of the ‘216 patent, the patentee stated that, with respect to claim 39 (which later issued as claim 9), “a person of skill in the art would know the arrangement of the metal sulfonate salt based on the claims as written and the specification. Specifically, the metal sulfonate salt is attached to the aromatic ring of the respective sulfonic acid.” (D.I. 213 at JA126) The patentee then provided an example and a structural diagram showing a covalent bond. (See *id.* at JA126-27) However, the example and structural diagram did not disclaim noncovalent bonding; the patentee never even mentioned covalent bonding. Therefore, the patentee did not define “attached” in the intrinsic evidence.

The term “attached” is not a term of art in chemistry and carries no specialized meaning to persons skilled in the art. Its ordinary meaning is “joined; connected; bound.” *Random House Kernerman Webster’s College Dictionary* (2010). Absent any limiting definition or use in the intrinsic evidence, the court construes the term in order to clarify that, pursuant to its plain and ordinary meaning, it may encompass more than

¹⁸Invista contends that courts have construed “attached” broadly, according to its plain and ordinary meaning, to not require direct attachment. (D.I. 211 at 20) (citing *Thorner v. Sony Computer Entm’t Am. LLC*, 669 F.3d 1362, 1367-68 (Fed. Cir. 2012); *Rosco, Inc. v. Velvac Inc.*, Civ. No. 11-117, 2012 WL 6028239, at *7 (D. Del. Dec. 4, 2012)) However, the cases that Invista cites are not particularly helpful because the patents-at-issue in those cases related to physical, not chemical, methods of attachment.

covalent bonding. The court construes “attached” to mean “covalently or noncovalently bonded.”

7. “Metal sulfonate salt”

“Metal sulfonate salt” is a limitation of both the ‘159 and ‘216 patents. M&G avers that “metal sulfonate salt” means “a sulfonate salt group covalently bonded to an aromatic acid nucleus of a sulfomonomer” and that the sulfonate salt group can only be “Na⁺ or Zn⁺⁺. (D.I. 209) Invista proposes that, to the extent the court decides the limitation requires construction, it is “a salt of sulfonic acid wherein the cation is a metal ion.” (*Id.*)

M&G’s proposed construction is too narrow. First, the specification of the ‘159 and ‘216 patents does not mention covalent bonding, only attachment. Thus, the metal sulfonate salt does not have to be covalently bonded to an aromatic acid nucleus. Second, while the specification teaches a metal sulfonate salt being “attached to an aromatic acid nucleus,” it only does so in the context of discussing the “copolyester” limitation, wherein the copolyester contains or comprises a metal sulfonate salt. (See ‘216 patent, col. 4:67-5:1) Therefore, while the claimed copolyester in the ‘159 and ‘216 patents must include a metal sulfonate salt, as discussed *supra*, such a requirement has been incorporated into the court’s construction for “copolyester containing a metal sulfonate salt” (‘159 patent) and “copolyester comprising a metal sulfonate salt” (‘216 patent).

The parties also dispute whether a metal sulfonate salt is limited to only certain metal ions. M&G’s assertion that the metal ion of metal sulfonate salt can only be Na⁺

or Zn⁺⁺ runs counter to the specification and claims. The independent claims of the '159 and '216 patents do not limit the metal sulfonate salt to any particular metal ions. (See '159 patent, claims 1, 13, 15, 17; '216 patent, claim 1) Moreover, both the preferred embodiments described in the specification and the dependent claims of the patents specify at least six possible metal cations: Na⁺, Li⁺, K⁺, Zn⁺⁺, Mn⁺⁺, or Ca⁺⁺. ('159 patent, col. 13:52-59; '216 patent, col. 14:17-19)

To the extent M&G asserts that the '159 and '216 patents only describe Na⁺ and Zn⁺⁺ as ions of metal sulfonate salts that can be used to achieve the purportedly "surprising" results, such an argument is more appropriately raised as a theory of invalidity. Therefore, the court agrees with Invista's proposed construction that "metal sulfonate salt" is "a salt of sulfonic acid wherein the cation is a metal ion."

8. "Cobalt salt"

"Cobalt salt" is a limitation in the '159 and '216 patents. Similar to its proposed construction for "metal sulfonate salt," M&G asserts that "cobalt salt" is limited to only certain salts – cobalt octoate, cobalt acetate, cobalt stearate, and cobalt naphthenate – because these were the only cobalt salts described and shown to purportedly achieve the "surprising" results alleged for the invention. (D.I. 209; D.I. 230 at 19)

Consistent with its analysis as to "metal sulfonate salt," the court declines to adopt M&G's narrow construction for "cobalt salt." Dependent claim 7 of the '216 patent and dependent claim 8 of the '159 patent recite numerous specific cobalt salts besides the few that M&G proposes in its construction. Again, to the extent M&G asserts that the '159 and '216 patents only mention four cobalt salts that achieve the purportedly "surprising" results, such an argument is more appropriately raised as an

invalidity argument. The court construes “cobalt salt” to mean, consistent with Invista’s position, “a salt wherein the cation is cobalt.”

9. “Is present”

Finally, the parties dispute the term “is present,” which is recited in claims 2-4 of the ‘216 patent and claims 2-4, 14, 15, and 16 of the ‘159 patent. M&G proposes that it means “an ingredient exists in a physical mixture,” whereas Invista asserts the term requires no claim construction. (D.I. 209) The court finds that, at this juncture, “is present” does not require construction.

B. The Disputed Limitations of the ‘930 Patent¹⁹

1. “Melt blended resin” / “melt blend”

The parties agree that “melt blended resin” and “melt blend” should be construed together. (*Id.*) M&G proposes the construction “a homogeneous blend formed by mixing two or more polymers in a molten phase.” (*Id.*) Invista proposes the plain and ordinary meaning and disagrees with M&G’s proposed construction to the extent it requires the blend to be homogeneous. (D.I. 368 at 82:4-12)

The specification of the ‘930 patent describes one embodiment in which the components are added to an injection molding machine, which is designed “to produce a homogeneous blend.” (‘930 patent, col. 5:44-54) The rest of the specification teaches “melt blended resin” and “melt blend” in a generic sense, without any limitation

¹⁹Although listed as a disputed limitation in the parties’ joint claim construction chart (D.I. 209), Invista and M&G do not discuss “oxidizable organic polymer” (asserted claims 1 and 5 of the ‘930 patent) in their claim construction briefs. (See D.I. 211; D.I. 230; D.I. 247; D.I. 252) As a result, the court does not construe the “oxidizable organic polymer” limitation at this time.

that the blend be homogeneous. (See *id.*, abstract, col. 2:33, 2:44-63, 2:66-3:2, 4:67-5:1, 5:61-62, 7:38) Similarly, nothing in the claim language indicates that a “melt blended resin” or “melt blend” must be homogeneous.

During the *Markman* hearing, M&G proposed dropping the reference to “homogeneous” in its proposed construction. (D.I. 368 at 85:8-13) The court finds this to be consistent with the written description of the ‘930 patent and, accordingly, construes “melt blended resin” and “melt blend” to mean “a blend formed by mixing two or more polymers in a molten phase.”

2. “A base polymer”

M&G proposes that “a base polymer” should be construed to mean “a polymer blend that does not contain an ionic compatibilizer.” (D.I. 209) “Base polymer” and “ionic compatibilizer” are not recited as separate and distinct components in the broadest sense of the claimed invention. Independent claim 1 of the ‘930 patent does not recite an ionic compatibilizer as a required component of the claimed invention. Rather, dependent claim 10 narrows independent claim 1 by reciting a melt blended resin that also includes an “ionic compatibilizer.” The specification of the ‘930 patent also makes clear that the ionic compatibilizer is an optional component. (‘930 patent, col. 2:47-49, col. 3:2) Moreover, the patentee did not make a clear disclaimer that the “base polymer” must be a different component from the “ionic compatibilizer.”²⁰ (See D.I. 213 at JA765-66, JA805)

²⁰Compare the claim language and the prosecution history of the ‘159 patent, discussed *supra*, which warranted a limitation that the “polyester” and “ionic compatibilizer” components of that patent be separate and distinct.

Therefore, the court declines to construe “a base polymer” narrowly and require that it not contain an ionic compatibilizer. The court finds that “a base polymer” does not require construction; the plain and ordinary meaning suffices.

3. “Transition metal catalyst”

M&G asserts that “transition metal catalyst” is limited to only “cobalt stearate and cobalt acetate” because these were the only two transition metal catalysts disclosed that could achieve the results taught by the patent. (D.I. 209; D.I. 230 at 24-25) M&G cites to the prosecution history to assert that the patentee limited “transition metal catalyst” only to cobalt stearate. (D.I. 230 at 25) (citing D.I. 213 at JA765) However, the patentee stated that the then-pending claim “read on” the elected species and further clarified that the election was “made for searching purposes only and should not be construed as a limitation of the present invention.” (D.I. 213 at JA765-66)

The specification of the ‘930 patent uses “transition metal catalyst” broadly and does not limit it to cobalt stearate and cobalt acetate. The detailed description of the invention provides that “[t]he transition metal catalyst can be a salt which includes a metal selected from the first, second, or third transition series of the Periodic Table,” those metals being the transition metals. (‘930 patent, col. 5:2-4) It is only in dependent claim 8 of the ‘930 patent that a “transition metal catalyst” is limited to a specific type of transition metal catalyst, cobalt salt. Therefore, the court declines to adopt M&G’s narrow construction for “transition metal catalyst.” The court construes “transition metal catalyst,” consistent with the definition provided in the specification and Invista’s proposed construction, to be “a catalyst which includes a metal selected from the first, second, or third transition series of the Periodic Table.”

4. “Colorant”

M&G proposes that a “colorant” be defined as “the pure chemical compound responsible for imparting color that does not have any other additives such as carriers and other materials.” (D.I. 209) M&G’s proposed construction introduces limiting language that is not found in the written description or claim language of the ‘930 patent. Indeed, M&G’s claim construction briefs do not argue why a “colorant,” as used in the ‘930 patent, must be “pure” or “not have any other additives.” (See D.I. 230 at 26; D.I. 252 at 14) The court finds that there is no need to construe “colorant” beyond its plain and ordinary meaning.

5. “Polyester”

M&G proposes that a “polyester” is “a resin made from chains of monomer links; wherein individual chains are made from chaining together diacid monomer links with diol monomer links.” (D.I. 209) However, the specification of the ‘930 patent also teaches that polyesters can be made with diester monomer links. Specifically, it describes how polyesters can be prepared by one of two processes, either the ester process or the acid process. (‘930 patent, col. 3:15-16) In the former, a diester is reacted with a diol and, in the latter, a diacid is reacted with a diol. (*Id.*, col. 3:17-19, 3:33-36) As the court has noted, this understanding comports with the general definition of “polyester resin.” See *McGraw-Hill Dictionary of Scientific and Technical Terms, supra* (“A thermosetting or thermoplastic synthetic resin made by esterification of polybasic organic acids with polyhydric acids”); Lewis, Sr., *supra* (“Any of a group of synthetic resins, which are polycondensation products of dicarboxylic acids with

dihydroxy alcohols.”).

The intrinsic evidence of the ‘930 patent does not limit the meaning of “polyester.” Therefore, the court construes “polyester,” for purposes of the ‘930 patent, to mean “a resin made from chains of monomer links; wherein individual chains are made from chaining together diacid or diester monomer links with diol monomer links.”

6. “Cobalt salt”

Similar to its arguments for the “transition metal catalyst” limitation, M&G proposes that “cobalt salt” is limited to cobalt stearate and cobalt acetate. (D.I. 209) For the reasons set forth above, the court does not limit “cobalt salt” to those two species. The specification of the ‘930 patent does not limit the term, stating only that it is a common example of a transition catalyst. (‘930 patent, col. 1:53-55) Furthermore, claim 8 recites “cobalt salt” without further limitation, and dependent claim 9 narrows the cobalt salt to a specific species, cobalt stearate. Therefore, the court construes “cobalt salt” in a manner consistent with its plain and ordinary meaning, as well as the “cobalt salt” limitation of the ‘159 and ‘216 patents (which the court has found is also not limited to any particular species). “Cobalt salt” means “a salt wherein the cation is cobalt.”

7. “Copolyester of polyethylene terephthalate”

According to M&G, a “copolyester of polyethylene terephthalate” should be defined as “a polyester that contains more than one diol, more than one diacid, or a combination of more than one diol and more than one diacid; wherein one of the diacid monomer links is terephthalic acid and one of the diol monomer links is ethylene glycol.” (D.I. 209) The court does not find M&G’s proposed construction helpful, as

“polyethylene terephthalate” is a chemical compound for which the plain and ordinary meaning suffices. Therefore, the court does not construe “copolyester of polyethylene terephthalate” beyond its plain and ordinary meaning.

8. “Ionic compatibilizer”

For the “ionic compatibilizer” limitation of the ‘930 patent, M&G proposes the construction: “a copolyester containing an ionic group capable of reducing the domain size of an oxidizable organic polymer, which is inherently incompatible with the base polymer in a melt blend.” (*Id.*) Invista argues that, to the extent a construction is required, “ionic compatibilizer” means “a copolyester with an ionic compatibilizing group.” (*Id.*)

The detailed description of the invention teaches that, in certain cases where an oxygen scavenging polymer is incompatible with a base polymer, “an ionic compatibilizer can be used” (‘930 patent, col. 5:14-16) The ionic compatibilizer can “reduce the domain size of the oxidizable organic polymer, thus reducing the haze of the article.” (*Id.*, col. 5:16-17) Dependent claim 10 of the ‘930 patent explicitly recites the function taught in the specification as a separate limitation:

10. The melt blended resin of claim 1, wherein said resin contains an ionic compatibilizer, wherein the ionic compatibilizer **reduces the haze of the packaging articles.**

(Emphasis added)

Although the court does not adopt M&G’s proposed construction, it finds that a construction would be helpful because ionic compatibilizer is not a general term of art. To that end, the court adopts Invista’s proposed construction; an

“ionic compatibilizer” is “a copolyester with an ionic compatibilizing group.”²¹

9. “Compatibilizer”

The parties also dispute the meaning of “compatibilizer.” Dependent claim 10 of the ‘930 patent recites a resin that “contains an ionic compatibilizer” and is followed immediately by dependent claim 11, which recites “wherein **said compatibilizer . . .**” (Emphasis added) The specification also alternates between describing the invention as comprising “optionally a compatibilizer” (*id.*, col. 2:47-49, 3:2) and “optionally an ionic compatibilizer.” (*Id.*, col. 5:45-47) Therefore, it is clear from the claim language and the written description of the ‘930 patent that “compatibilizer” is used interchangeably with “ionic compatibilizer.” As such, the court construes “compatibilizer” the same as it has construed “ionic compatibilizer,” namely “a copolyester with an ionic compatibilizing group.”

10. “Copolyester containing a metal sulfonate salt”

Finally, as with the same phrase that appears in the ‘159 patent, the parties dispute whether the “copolyester containing a metal sulfonate salt” limitation of the ‘930 patent requires that the metal sulfonate salt be “attached” to the copolyester. (D.I. 209) Given that the ‘930 patent specification provides the same teaching regarding “copolyester containing a metal sulfonate salt” as does the ‘159 patent specification, the court’s reasoning supporting the construction of that phrase for the ‘159 patent applies

²¹The court has construed the “ionic compatibilizer” limitation differently for purposes of the ‘159 patent. Unlike the ‘930 patent, the independent claims of the ‘159 patent expressly defined “ionic compatibilizer” as a “copolyester containing a metal sulfonate salt.” In the ‘930 patent, “copolyester containing a metal sulfonate salt” is just one embodiment of “ionic compatibilizer.”

here. In short, the '930 specification teaches that, in a "copolyster containing a metal sulfonate salt," the metal sulfonate salt is attached to the aromatic acid nucleus of a sulfomonomer, which the parties agree is part of the copolyester. ('930 patent, col. 5:18-31; D.I. 211 at 22; D.I. 230 at 29) As explained *supra*, this teaching does not require the metal sulfonate salt to be directly attached to the copolyester, only the aromatic acid nucleus. Moreover, the term "containing" is open-ended and does not foreclose additional, unrecited elements. Therefore, the court construes "copolyster containing a metal sulfonate salt" in the same manner that it construed that phrase for the '159 patent: "a copolyester including, but not limited to, a metal sulfonate salt."

V. CONCLUSION

For the foregoing reasons, the court construes the claim language of the patents-in-suit in the manner set forth above. An appropriate order shall issue.

IN THE UNITED STATES DISTRICT COURT

FOR THE DISTRICT OF DELAWARE

INVISTA NORTH AMERICA S.À.R.L.)
and AURIGA POLYMERS INC.,)
)
Plaintiffs,)
)
v.) Civ. No. 11-1007-SLR-CJB
)
M&G USA CORPORATION and M&G)
POLYMERS USA, LLC,)
)
Defendants.)

O R D E R

At Wilmington this 25th day of June, 2013, consistent with the memorandum opinion issued this same date;

IT IS ORDERED that:

1. "Composition" ('159 and '216 patents) means "a blend that contains the specified ingredients at any time from the moment the ingredients are mixed together."
2. "Ionic compatibilizer" ('159 patent) means "copolyester containing a metal sulfonate salt."
3. "Copolyester containing a metal sulfonate salt" ('159 patent) means "a copolyester including, but not limited to, a metal sulfonate salt."
4. "Copolyester comprising a metal sulfonate salt" ('216 patent) means "a copolyester including, but not limited to, a metal sulfonate salt."
5. "Polyester" ('159 patent) means "a resin made from chains of monomer links; wherein individual chains are made from chaining together diacid or diester monomer

links with diol monomer links and the resin is not an ionic compatibilizer."

6. "Attached" ('159 and '216 patents) means "covalently or noncovalently bonded."

7. "Metal sulfonate salt" ('159 and '216 patents) means "a salt of sulfonic acid wherein the cation is a metal ion."

8. "Cobalt salt" ('159 and '216 patents) means "a salt wherein the cation is cobalt."

9. "Is present" ('159 and '216 patents) does not require construction.

10. "Melt blended resin" and "melt blend" ('930 patent) mean "a blend formed by mixing two or more polymers in a molten phase."

11. "A base polymer" ('930 patent) does not require construction.

12. "Transition metal catalyst" ('930 patent) means "a catalyst which includes a metal selected from the first, second, or third transition series of the Periodic Table."

13. "Colorant" ('930 patent) does not require construction.

14. "Polyester" ('930 patent) means "a resin made from chains of monomer links; wherein individual chains are made from chaining together diacid or diester monomer links with diol monomer links."

15. "Copolyester of polyethylene terephthalate" ('930 patent) does not require construction.

16. "Cobalt salt" ('930 patent) means "a salt wherein the cation is cobalt."

17. "Ionic compatibilizer" ('930 patent) means "a copolyester with an ionic compatibilizing group."

18. "Compatibilizer" ('930 patent) means "a copolyester with an ionic

compatibilizing group."

19. "Copolyester containing a metal sulfonate salt" ('930 patent) means "a copolyester including, but not limited to, a metal sulfonate salt."



United States District Judge

IN THE UNITED STATES DISTRICT COURT

FOR THE DISTRICT OF DELAWARE

INVISTA NORTH AMERICA S.À.R.L.)
and AURIGA POLYMERS INC.)
)
Plaintiffs,)
)
v.) Civ. No. 11-1007-SLR-CJB
)
M&G USA CORPORATION and M&G)
POLYMERS USA, LLC,)
)
Defendants.)

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MEMORANDUM OPINION

Dated: June 25, 2013
Wilmington, Delaware



ROBINSON, District Judge

I. INTRODUCTION

Plaintiffs INVISTA North America S.à.r.l. ("Invista NA") and Auriga Polymers Inc. ("Auriga Polymers")¹ (collectively, "Invista") are suing M&G USA Corporation ("M&G Corp.") and M&G Polymers USA, LLC ("M&G LLC") (collectively, "M&G") for infringement of United States Patent Nos. 7,919,159 ("the '159 patent"), 7,943,216 ("the '216 patent"), and 7,879,930 ("the '930 patent") (collectively, "the patents-in-suit"). (D.I. 1; D.I. 7) M&G has asserted counterclaims seeking declaratory judgment of non-infringement and invalidity of the patents-in-suit. (D.I. 42)

The patents-in-suit relate to plastic materials with applications in packaging for oxygen-sensitive foods and beverages. The court has construed, in a separate memorandum opinion and order, the disputed limitations of the patents-in-suit and has resolved, in a separate memorandum order, various motions by Invista and M&G to strike or exclude certain expert testimony and filings. Currently before the court are several summary judgment motions: Invista's motion for partial summary judgment of infringement (D.I. 231); M&G's cross-motion for summary judgment of non-infringement (D.I. 265); M&G's motion for summary judgment of invalidity (D.I. 233); and Invista's cross-motion for partial summary judgment of validity (D.I. 262). The court has jurisdiction over these matters pursuant to 28 U.S.C. § 1338.

II. BACKGROUND

A. The Parties

Invista NA, one of the world's largest integrated producers of polymers, is a

¹Auriga Polymers was added as a plaintiff by a joint stipulation entered by the court on April 30, 2012. (D.I. 52)

corporation organized under the laws of Luxembourg, with its headquarters in Wichita, Kansas. (D.I. 7 at ¶ 2) It sold off its North American business, which became Auriga Polymers. (D.I. 368 at 6:8-10) Invista NA owns the patents-in-suit, while Auriga Polymers is the exclusive licensee. (*Id.* at 6:2, 6:10-11)

M&G Corp. and M&G LLC are both Delaware corporations. (D.I. 7 at ¶¶ 3-4; D.I. 42 ¶¶ 3-4) M&G Corp. has its principal place of business in Ohio, and M&G LLC has its principal place of business in West Virginia. (D.I. 7 at ¶¶ 3-4; D.I. 42 ¶¶ 3-4)

B. Technology Overview

Plastic polymers are commonly used for making food and beverage containers and offer several advantages over the use of glass or metal. They are lighter in weight, have less breakage, and can potentially lower costs. ('216 patent, col. 1:25-27)² Polymers are synthesized by reacting monomers to form a larger polymer chain, and they can be made into bottles by a method called stretch blow molding. In stretch blow molding, a polymer resin is typically dried, melted and extruded into preforms. (*Id.*, col. 7:56-58) The preforms are then heated and blown-molded into bottles of desired shape and size. (*Id.*, col. 7:62-64)

One type of polymer, polyester, has been widely used in the bottling industry for many years. Polyethylene terephthalate ("PET") is a common example of a polyester. (*Id.*, col. 2:34, 8:16) Polyesters can be prepared by reacting diesters (e.g., dicarboxylic ester) or diacids (e.g., terephthalic acid) with ethylene glycol ("EG"). (*Id.*, col. 3:27-31) However, polyesters have inferior gas-barrier properties. Because they are not

²As the '159 and '216 patents share a specification, the court will cite to the '216 patent for convenience, except when discussing the '159 patent in particular.

impervious to gas, they limit the shelf life of oxygen-sensitive foods, condiments, and beverages (such as juice, soda, or beer). (*Id.*, col. 1:27-33)

In the prior art, it was known that the use of low-gas permeable polymers, known as partially aromatic polyamides (or “nylons”), with polyesters increases barrier properties. (*Id.*, col. 1:31-38) Partially aromatic polyamides have non-scavenging, or “passive,” barrier properties – they restrict carbon dioxide leakage from, and oxygen intrusion into, a container by obstructing the paths of gas molecules. (*Id.*, col. 1:21; ‘930 patent, col. 2:22) However, partially aromatic polyamides are not miscible – they do not mix well – with polyesters like PET, and they also give containers an undesirable yellow and hazy appearance. (‘216 patent, col. 1:44-46)

It was commonly known in the art that combining a thin layer of a partially aromatic polyamide, like MXD6,³ with one or more layers of polyester in multilayer bottles increased barrier properties. (*Id.*, col. 1:35-43; ‘930 patent, col. 2:18-25) This multilayer system, however, produced bottles with undesirable haze. (‘216 patent, col. 1:33-35)

It was also known in the art that the addition of a transition metal catalyst, such as cobalt salt, improved the gas barrier properties of polyamide multilayer containers and blends with PET by promoting active oxygen scavenging. (*Id.*, col. 2:32-48; ‘930 patent, col. 1:30-31, 1:51-5-55) As opposed to a passive barrier, this “active” barrier reacts with oxygen in the process of traversing the package barrier. (‘930 patent, col. 1:33-38)

³MXD6 is the commercial name for poly(meta-xylylene adipamide). (‘930 patent, col. 1:50-51, 4:59-60)

C. The Inventions and Patents-in-Suit

1. The '159 and '216 patents

According to the patentee, no prior art disclosed a monolayer container with a desirable balance of high gas barrier properties and low yellowness and haze, as taught by the '159 and '216 patents. ('216 patent, col. 2:55-61, 2:65-3:13) The inventions are useful as packaging for oxygen-sensitive foods that require a long shelf life. (*Id.*, col. 2:55-67)

The '159 patent discloses a four-component composition. Claim 1 of the '159 patent provides:

1. A composition for containers comprising: polyester, partially aromatic polyamide, ionic compatibilizer, and a cobalt salt; wherein said ionic compatibilizer is a copolyester containing a metal sulfonate salt.

As discussed, the partially aromatic polyamide provides a passive barrier. The cobalt salt is a transition metal catalyst that "activates" the partially aromatic polyamide to form an active barrier that scavenges oxygen, thereby improving barrier properties. The patentee reports that the ionic compatibilizer allows a "synergistic reduction" in yellowness and haze and "surprisingly" increases barrier properties even further. ('159 patent, col. 5:22-25, 9:58-61)

The '216 patent is a division of the '159 patent and shares the same specification. (See '216 patent, col. 1:8-9) The '216 patent discloses a three-component composition. Claim 1 of the '216 patent recites:

1. A composition for containers comprising:
a copolyester comprising a metal sulfonate salt;

a partially aromatic polyamide;

and a cobalt salt.

The composition of the '216 patent differs from that of the '159 patent in that it replaces the polyester and ionic compatibilizer components and recites, in their place, "a copolyester comprising a metal sulfonate salt." The other claims of the '216 and '159 patents disclose more specific compositions, as well as articles and containers made from the compositions.

2. The '930 patent

Invista is asserting indirect infringement of claims 1, 3-6, 8, 10, and 11 of the '930 patent, which relates to colored oxygen scavenging polymers and articles made from such polymers, such as green, blue, or amber bottles. ('930 patent, col. 1:7-8, 2:20) In the prior art, it was not problematic to use colorants because there would be no reaction between the colorant, which was added to the non-scavenging (or passive barrier) layers and the transition metal catalyst, which was contained in the oxygen scavenging (or active barrier) layer. (*Id.*, col. 2:20-25) However, in monolayer articles, such as those taught in the '159 and '216 patents, the colorant is intimately mixed in a melt phase with the transition metal catalyst. (*Id.*, col. 2:35-38) Some colorants deactivate the transition metal catalyst after melt blending, which makes the transition metal catalyst less effective as a catalyst. (*Id.*, col. 2:32-34)

The '930 patent relates to the use of certain colorants that do not completely deactivate the catalyst and, thus, are suitable for use with a transition metal catalyst in monolayer scavenging systems. (*Id.*, col. 2:42-44) The specification of the '930 patent

describes the methods used to determine the catalyst deactivation properties of colorants. The oxygen permeability of each specimen was measured at zero percent relative humidity, one atmosphere pressure, and 23° C, and was expressed in the units (cc(STP) cm)/(m² atm day). (*Id.*, col. 6:58-59) Then the catalyst deactivation factor (“CDF”) was defined as: “(oxygen permeability of base polymer, oxidizable organic polymer, transition metal catalyst and 0.25 weight % colorant) / (oxygen permeability of base polymer and oxidizable organic polymer).” (*Id.*, col. 6:59-64) In other words, the CDF is the oxygen permeability of the activated polymer blend with 0.25 weight % colorant, expressed as a fraction of the oxygen permeability of the passive polymer blend without any colorant. A CDF of 1 corresponds to complete deactivation (such that the composition containing the active barrier and colorant has the same oxygen permeability as the passive barrier), whereas a CDF of 0 corresponds to no deactivation of the oxidation catalyst. (*Id.*, col. 6:65-67)

The '930 patent claims a melt blended resin, monolayer film or article comprising a base polymer, an oxidizable organic polymer, a transition metal catalyst, and a colorant. (*Id.*, col. 2:44-63) The colorant of the claimed invention has a CDF of less than about 0.25, preferably less than 0.15, more preferably less than 0.1, and most preferably less than 0.05. (*Id.*, abstract, col. 8:2-4) The blend may also optionally include a compatibilizer and other additives. (*Id.*, col. 2:47-48, 5:33-44) There is one independent claim among the asserted claims of the '930 patent:

1. A melted blended resin for packaging articles comprising:

a base polymer;

oxidizable organize polymer;

transition metal catalyst; and

a colorant;

such that an article made from said melt blended resin has a catalyst deactivation factor of less than 0.25, and further wherein said base polymer is selected from the gorup consisting of polyethylene, polyester, polyvinyl chloride, polyvinylidene chloride, ethylene copolymers, and blends thereof.

D. The Accused Products

Invista accuses M&G's PoliProtect APB⁴ and PoliProtect JB⁵ products (collectively, the "PoliProtect products"), resins sold in the form of pellets, of infringing the patents-in-suit. (See D.I. 42 at ¶ 12) The PoliProtect products are suitable for applications in food and beverage packaging. (D.I. 237 at PA284) Each pellet has a "passive barrier" inner layer, or core, made of nylon and an outer layer made of a copolyester with antimony, cobalt, phosphorus, lithium, and sulfur; the outer layer catalyzes the "activation" of the inner core into an "active" oxygen scavenging barrier. (*Id.* at PA151-54, PA251, PA264, PA283-85, PA453-54 86:13-87:13; D.I. 266 at 5, 12) M&G markets the bilayer feature of the PoliProtect products as BicoPET™ technology. (See D.I. 237 at PA151-53, PA251, PA264, PA283-85) The parties agree that the primary difference between PoliProtect APB and PoliProtect JB is the amount of oxidizable components in each (5.0 weight % in PoliProtect APB and 2.9 weight % in PoliProtect JB). (D.I. 232 at 9; 266 at 5)

⁴The "APB" in the product name stands for "Active and Passive Barrier." (D.I. 237 at PA284)

⁵The "JB" in the product name stands for "Juice Barrier." (D.I. 237 at PA284)

III. STANDARD

“The court shall grant summary judgment if the movant shows that there is no genuine dispute as to any material fact and the movant is entitled to judgment as a matter of law.” Fed. R. Civ. P. 56(a). The moving party bears the burden of demonstrating the absence of a genuine issue of material fact. *Matsushita Elec. Indus. Co. v. Zenith Radio Corp.*, 415 U.S. 574, 586 n.10 (1986). A party asserting that a fact cannot be – or, alternatively, is – genuinely disputed must demonstrate such, either by citing to “particular parts of materials in the record, including depositions, documents, electronically stored information, affidavits or declarations, stipulations (including those made for the purposes of the motions only), admissions, interrogatory answers, or other materials,” or by “showing that the materials cited do not establish the absence or presence of a genuine dispute, or that an adverse party cannot produce admissible evidence to support the fact.” Fed. R. Civ. P. 56(c)(1)(A) & (B). If the moving party has carried its burden, the nonmovant must then “come forward with specific facts showing that there is a genuine issue for trial.” *Matsushita*, 415 U.S. at 587 (internal quotation marks omitted). The court will “draw all reasonable inferences in favor of the nonmoving party, and it may not make credibility determinations or weigh the evidence.” *Reeves v. Sanderson Plumbing Prods., Inc.*, 530 U.S. 133, 150 (2000).

To defeat a motion for summary judgment, the non-moving party must “do more than simply show that there is some metaphysical doubt as to the material facts.” *Matsushita*, 475 U.S. at 586-87; see also *Podohnik v. U.S. Postal Serv.*, 409 F.3d 584, 594 (3d Cir. 2005) (stating party opposing summary judgment “must present more than

just bare assertions, conclusory allegations or suspicions to show the existence of a genuine issue") (internal quotation marks omitted). Although the "mere existence of some alleged factual dispute between the parties will not defeat an otherwise properly supported motion for summary judgment," a factual dispute is genuine where "the evidence is such that a reasonable jury could return a verdict for the nonmoving party." *Anderson v. Liberty Lobby, Inc.*, 411 U.S. 242, 247-48 (1986). "If the evidence is merely colorable, or is not significantly probative, summary judgment may be granted." *Id.* at 249-50 (internal citations omitted); see also *Celotex Corp. v. Catrett*, 411 U.S. 317, 322 (1986) (stating entry of summary judgment is mandated "against a party who fails to make a showing sufficient to establish the existence of an element essential to that party's case, and on which that party will bear the burden of proof at trial").

A. Infringement

A patent is infringed when a person "without authority makes, uses or sells any patented invention, within the United States . . . during the term of the patent." 35 U.S.C. § 271(a). To prove direct infringement, the patentee must establish, by a preponderance of the evidence, that one or more claims of the patent read on the accused device literally or under the doctrine of equivalents. See *Advanced Cardiovascular Sys., Inc. v. Scimed Life Sys., Inc.*, 261 F.3d 1329, 1336 (Fed. Cir. 2001). A two-step analysis is employed in making an infringement determination. See *Markman v. Westview Instruments, Inc.*, 52 F.3d 967, 976 (Fed. Cir. 1995). First, the court must construe the asserted claims to ascertain their meaning and scope. See *id.* Construction of the claims is a question of law subject to de novo review. See *Cybor*

Corp. v. FAS Techs., 138 F.3d 1448, 1454 (Fed. Cir. 1998). The trier of fact must then compare the properly construed claims with the accused infringing product. See *Markman*, 52 F.3d at 976. This second step is a question of fact. See *Bai v. L & L Wings, Inc.*, 160 F.3d 1350, 1353 (Fed. Cir. 1998).

“Direct infringement requires a party to perform each and every step or element of a claimed method or product.” *BMC Res., Inc. v. Paymentech, LP*, 498 F.3d 1373, 1378 (Fed. Cir. 2007). “If any claim limitation is absent from the accused device, there is no literal infringement as a matter of law.” *Bayer AG v. Elan Pharm. Research Corp.*, 212 F.3d 1241, 1247 (Fed. Cir. 2000). If an accused product does not infringe an independent claim, it also does not infringe any claim depending thereon. See *Wahpeton Canvas Co. v. Frontier, Inc.*, 870 F.2d 1546, 1553 (Fed. Cir. 1989). However, “[o]ne may infringe an independent claim and not infringe a claim dependent on that claim.” *Monsanto Co. v. Syngenta Seeds, Inc.*, 503 F.3d 1352, 1359 (Fed. Cir. 2007) (quoting *Wahpeton Canvas*, 870 F.2d at 1552) (internal quotation marks omitted). A product that does not literally infringe a patent claim may still infringe under the doctrine of equivalents if the differences between an individual limitation of the claimed invention and an element of the accused product are insubstantial. See *Warner-Jenkinson Co. v. Hilton Davis Chem. Co.*, 520 U.S. 17, 24 (1997).

To establish indirect infringement, a patent owner has available two theories: active inducement of infringement and contributory infringement. See 35 U.S.C. § 271(b) & (c). To establish active inducement of infringement, a patent owner must show that an accused infringer “knew or should have known [its] actions would induce

actual infringements.” *DSU Med. Corp. v. JMS Co.*, 471 F.3d 1293, 1306 (Fed. Cir. 2006). To establish contributory infringement, a patent owner must show that an accused infringer sells “a component of a patented machine . . . knowing the same to be especially made or especially adapted for use in an infringement of such patent, and not a staple article or commodity of commerce suitable for substantial noninfringing use.” *Golden Blount, Inc. v. Robert H. Peterson Co.*, 365 F.3d 1054, 1061 (Fed. Cir. 2004) (quoting 35 U.S.C. § 271(c)). Liability under either theory, however, depends on the patent owner having first shown direct infringement. *Joy Techs., Inc. v. Flakt, Inc.*, 6 F.3d 770, 774 (Fed. Cir. 1993).

When an accused infringer moves for summary judgment of non-infringement, such relief may be granted only if one or more limitations of the claim in question does not read on an element of the accused product, either literally or under the doctrine of equivalents. See *Chimie v. PPG Indus., Inc.*, 402 F.3d 1371, 1376 (Fed. Cir. 2005); see also *TechSearch, LLC v. Intel Corp.*, 286 F.3d 1360, 1369 (Fed. Cir. 2002) (“Summary judgment of non-infringement is . . . appropriate where the patent owner's proof is deficient in meeting an essential part of the legal standard for infringement, because such failure will render all other facts immaterial.”). Thus, summary judgment of non-infringement can only be granted if, after viewing the facts in the light most favorable to the non-movant, there is no genuine issue as to whether the accused product is covered by the claims (as construed by the court). See *Pitney Bowes, Inc. v. Hewlett-Packard Co.*, 182 F.3d 1298, 1304 (Fed. Cir. 1999).

B. Invalidity

1. Obviousness

"A patent may not be obtained . . . if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art." 35 U.S.C. § 103(a). Obviousness is a question of law, which depends on underlying factual inquiries.

Under § 103, the scope and content of the prior art are to be determined; differences between the prior art and the claims at issue are to be ascertained; and the level of ordinary skill in the pertinent art resolved. Against this background the obviousness or nonobviousness of the subject matter is determined. Such secondary considerations as commercial success, long felt but unsolved needs, failure of others, etc., might be utilized to give light to the circumstances surrounding the origin of the subject matter sought to be patented.

KSR Int'l Co. v. Teleflex Inc., 550 U.S. 398, 406 (2007) (quoting *Graham v. John Deere Co.*, 383 U.S. 1, 17-18 (1966)).

"[A] patent composed of several elements is not proved obvious merely by demonstrating that each of its elements was, independently, known in the prior art." *KSR*, 550 U.S. at 418. Likewise, a defendant asserting obviousness in view of a combination of references has the burden to show that a person of ordinary skill in the relevant field had a reason to combine the elements in the manner claimed. *Id.* at 418-19. The Supreme Court has emphasized the need for courts to value "common sense" over "rigid preventative rules" in determining whether a motivation to combine existed. *Id.* at 419-20. "[A]ny need or problem known in the field of endeavor at the time of invention and addressed by the patent can provide a reason for combining the elements in the manner claimed." *Id.* at 420. In addition to showing that a person of

ordinary skill in the art would have had reason to attempt to make the composition or device, or carry out the claimed process, a defendant must also demonstrate that "such a person would have had a reasonable expectation of success in doing so."

PharmaStem Therapeutics, Inc. v. ViaCell, Inc., 491 F.3d 1342, 1360 (Fed. Cir. 2007).

A combination of prior art elements may have been "obvious to try" where there existed "a design need or market pressure to solve a problem and there [were] a finite number of identified, predictable solutions" to it, and the pursuit of the "known options within [a person of ordinary skill in the art's] technical grasp" leads to the anticipated success. *Id.* at 421. In this circumstance, "the fact that a combination was obvious to try might show that it was obvious under § 103." *Id.*

A court is required to consider secondary considerations, or objective indicia of nonobviousness, before reaching an obviousness determination, as a "check against hindsight bias." See *In re Cyclobenzaprine Hydrochloride Extended-Release Capsule Patent Litig.*, 676 F.3d 1063, 1079 (Fed. Cir. 2012). "Such secondary considerations as commercial success, long felt but unsolved needs, failure of others, etc., might be utilized to give light to the circumstances surrounding the origin of the subject matter sought to be patented." *John Deere Co.*, 383 U.S. at 17-18.

"Because patents are presumed to be valid, see 35 U.S.C. § 282, an alleged infringer seeking to invalidate a patent on obviousness grounds must establish its obviousness by facts supported by clear and convincing evidence." *Kao Corp. v. Unilever U.S., Inc.*, 441 F.3d 963, 968 (Fed. Cir. 2006) (citation omitted). In conjunction with this burden, the Federal Circuit has explained that,

[w]hen no prior art other than that which was considered by the PTO examiner is relied on by the attacker, he has the added burden of overcoming the deference that is due to a qualified government agency presumed to have properly done its job, which includes one or more examiners who are assumed to have some expertise in interpreting the references and to be familiar from their work with the level of skill in the art and whose duty it is to issue only valid patents.

PowerOasis, Inc. v. T-Mobile USA, Inc., 522 F.3d 1299, 1304 (Fed. Cir. 2008) (quoting *Am. Hoist & Derrick Co. v. Sowa & Sons*, 725 F.2d 1350, 1359 (Fed. Cir. 1984)).

2. Written description

The statutory basis for the enablement and written description requirements, 35 U.S.C. § 112 ¶1, provides in relevant part:

The specification shall contain a written description of the invention, and of the manner and process of making and using it, in such full, clear, concise, and exact terms as to enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to make and use the same

The written description must “clearly allow persons of ordinary skill in the art to recognize that [the inventor] invented what is claimed.” *Ariad Pharm., Inc. v. Eli Lilly & Co.*, 598 F.3d 1336, 1351 (Fed. Cir. 2010) (en banc) (citation omitted) (internal quotation marks omitted). “In other words, the test for sufficiency is whether the disclosure of the application relied upon reasonably conveys to those skilled in the art that the inventor had possession of the claimed subject matter as of the filing date.” *Id.* (citations omitted). “The level of detail required to satisfy the written description requirement depends, in large part, on the nature of the claims and the complexity of the technology.” *Streck, Inc. v. Research & Diagnostic Sys., Inc.*, 665 F.3d 1269, 1285 (Fed. Cir. 2012). Neither examples nor actual reduction to practice is required; “a

constructive reduction to practice that in a definite way identifies the claimed invention can satisfy the written description requirement.” *Id.* (quoting *Ariad*, 598 F.3d at 1352).

Defendants must ultimately prove that the written description fails these standards by clear and convincing evidence. See *PowerOasis*, 522 F.3d at 1307 (citing *Invitrogen Corp. v. Clontech Labs., Inc.*, 429 F.3d 1052, 1072-73 (Fed. Cir. 2005)). While compliance with the written description requirement is a question of fact, it is “amenable to summary judgment in cases where no reasonable fact finder could return a verdict for the nonmoving party.” *Streck*, 665 F.3d at 1285 (quoting *PowerOasis*, 522 F.3d at 1307).

3. Enablement

The enablement requirement also comes from the language of 35 U.S.C. § 112, which requires the specification “to **enable** any person skilled in the art” to make and use the invention. (Emphasis added). The “enablement requirement is satisfied when one skilled in the art, after reading the specification, could practice the claimed invention without undue experimentation.” *AK Steel Corp. v. Sollac*, 344 F.3d 1234, 1244 (Fed. Cir. 2003). As part of the bargain between the inventor and the public, “[t]he full scope of the claimed invention must be enabled.” *Sitrick v. Dreamworks, LLC*, 516 F.3d 993, 999 (Fed. Cir. 2008). However, “[t]hat is not to say that the specification itself must necessarily describe how to make and use every possible variant of the claimed invention, for the artisan’s knowledge of the prior art and routine experimentation can often fill gaps, interpolate between embodiments, and perhaps even extrapolate beyond the disclosed embodiments, depending upon the predictability of the art.” *AK Steel*,

344 F.3d at 1244; see also *Chiron Corp. v. Genentech, Inc.*, 363 F.3d 1247, 1253 (Fed. Cir. 2004). As such, the specification does not need to include information that persons of ordinary skill in the art would already know. *Koito Mfg. Co. v. Turn-Key-Tech, LLC*, 381 F.3d 1142, 1156 (Fed. Cir. 2004).

Whether a claim satisfies the enablement requirement is a question of law based on underlying facts. See *Sitrick*, 516 F.3d at 999. Defendants carry the burden of proving that the specification fails to meet the enablement requirement by clear and convincing evidence. See *id.*

4. Indefiniteness

The second paragraph of 35 U.S.C. § 112 provides that “the specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.” The Federal Circuit has set forth the test for indefiniteness as follows: “If one skilled in the art would understand the bounds of the claim when read in light of the specification, then the claim satisfies section 112 paragraph 2.” *Exxon Research & Eng’g Co. v. United States*, 265 F.3d 1371, 1375 (Fed. Cir. 2001). The issue of indefiniteness presents a question of law, and the defendant bears the burden of proof by clear and convincing evidence. *Id.* at 1376.

IV. DISCUSSION

A. Infringement

1. Direct infringement of the '159 and '216 patents⁶

Invista moves for summary judgment of direct infringement of the '159 and '216 patents,⁷ and M&G cross-moves for no direct infringement. The court begins by comparing the PoliProtect products to the "composition" limitation of the '159 and '216 patents.

The court has construed "composition" to mean "a blend that contains the specified ingredients at any time from the moment the ingredients are mixed together." The undisputed facts show that the PoliProtect products are manufactured as pellets that have an inner core made of a partially aromatic polyamide, which constitutes a passive barrier, and an outer layer made of various components that activate the inner core's passive barrier. Invista's expert, Dr. Turner, does not dispute that the components of the PoliProtect products are separated into different layers. (D.I. 237 at PA53 ¶¶ 151-52, PA 87-88 ¶¶ 307-08) Nevertheless, he opines that the PoliProtect

⁶In its combined surreply and reply brief on summary judgment of infringement, M&G argues that Invista failed to provide any admissible expert testimony in support of its direct infringement claims because Dr. Turner's expert reports were unsworn. (D.I. 315 at 5-6) (citing *Rockwell Techs., LLC v. Spectra-Physics Lasers, Inc.*, Civ. No. 00-589, 2002 WL 523390, at *3 (D. Del. Apr. 8, 2002)) In *Fowle v. C & C Cola*, 868 F.2d 59, 67 (3d Cir. 1989), the Third Circuit found an unsworn expert report to be inadmissible on summary judgment for not complying with Federal Rule of Civil Procedure 56. The Court cautioned that "evidence should not be excluded on summary judgment on hypertechnical grounds" but emphasized that the plaintiff in that case "did nothing to correct the error before [the district court]." *Id.* Here, Invista has corrected the error – Dr. Turner filed a declaration on April 18, 2013, affirming that his opening and rebuttal reports, in their entirety, were made under oath. (D.I. 319) Moreover, there is no surprise to M&G. The expert reports were produced, marked at depositions, and incorporated into interrogatory responses, and Dr. Turner gave sworn deposition testimony regarding them. (See D.I. 368 at 88:19-22) Therefore, the court will consider Dr. Turner's expert reports as competent evidence on summary judgment.

⁷Invista does not allege direct infringement of the '930 patent. (D.I. 7)

products still literally meet the “composition” limitation because they are “mixtures” of passive and active barriers into one pellet, wherein the nylon core is the passive barrier and the components for the active barrier are in the outside layer. (*Id.* at PA26 ¶ 69, PA52 ¶¶ 149-52, PA87-88 ¶¶ 305-08)

Dr. Turner avers that M&G markets its PoliProtect products as “mixes” of active and passive barriers. (*Id.* at PA26 ¶ 69) The M&G documents that he cites state that the PoliProtect products use BicoPET™ technology, which “allows to mix in a single chip the active barrier and the passive barrier.” (*Id.* at PA283, PA305) The documents appear to be directed to the fact that the bilayer PoliProtect products allow one to combine the passive and active barriers when the pellets are mixed in order to form preforms or bottles. Even if the documents refer to the PoliProtect products being a “mix” of passive and active barriers, they do not meet the court’s construction of “composition.” A “composition” requires that all of the ingredients are mixed together in a blend; co-existing layers or barriers containing subsets of the ingredients do not meet the court’s construction. Under the court’s claim construction and the undisputed facts, the PoliProtect products do not practice the “composition” limitation of the ‘159 and ‘216 patents.

Invista also contends that the parties dispute whether there may be some mixing at the interface between the layers of the PoliProtect products. (D.I. 298 at 5) It argues that M&G’s expert, Dr. Moore, “did not test, and does not know, whether any mixing occurs at the interface of the two layers of the PoliProtect pellets.” (*Id.* at 5-6) Invista offers no affirmative evidence or expert testimony that any mixing occurs at the

interface between the layers of the PoliProtect products. In fact, it characterizes the testimony of its expert, Dr. Turner, as “establish[ing] nothing more than the [PoliProtect] Products are comprised of two layers, and the composition of those layers – not that there is no mixing between the layers.” (*Id.* at 5) Therefore, Invista attempts to create a material issue of fact to preclude summary judgment by relying on M&G’s lack of evidence regarding mixing at the interface. However, Invista carries the burden of showing infringement. As Invista has not identified any evidence of mixing between the layers of the PoliProtect products, it fails to establish a material factual dispute regarding mixing to preclude summary judgment of no direct infringement.

Because the PoliProtect products do not practice the “composition” limitation of the ‘159 and ‘216 patents, the court’s infringement inquiry on summary judgment ends here. The court grants summary judgment of no direct infringement of the ‘159 and ‘216 patents.

2. Indirect infringement of the ‘216 patent

Although the court has found that M&G does not directly infringe the ‘216 patent, Invista avers that summary judgment of indirect infringement is nonetheless appropriate because M&G’s customers necessarily infringe. Invista asserts that M&G’s customers take the PoliProtect products and melt blend them in the process of stretch blow molding preforms and bottles, thereby meeting the “composition” limitation. (D.I. 232 at 36-37) Invista further asserts that M&G meets the requisite knowledge for indirect infringement, at least after the filing of this lawsuit. M&G cross-moves for summary judgment of no indirect infringement of the ‘159 and ‘216 patents.

Invista contends that M&G sells its PoliProtect products to customers in the United States, who then melt them down in the process of making plastic containers or bottles. Invista supports its argument by citing M&G's sales spreadsheets listing sales of the PoliProtect products to U.S. customers, as well as an M&G interrogatory response stating that the PoliProtect products are "used in the manufacturing of PET barrier bottles." (See D.I. 237 at PA 198, PA233-39, PA397, PA460) Deposition testimony indicates that M&G customers "take the pellets and . . . dry them, and then . . . injection-mold them into whatever . . . article . . . they want to make," including preforms for bottles. (*Id.* at PA454-55 87:24-88:9; see also *id.* at PA458 97:5-19) M&G also allegedly provides instructions for molding and stretch blow molding in the data sheets for the PoliProtect products. (See *id.* at PA252, PA265)

On summary judgment, M&G is careful to avoid stating that its PoliProtect products are used for making any articles, such as food or beverage packaging or preforms for bottles. It attempts to rebut Invista's arguments by averring that Invista relies upon speculation and conjecture as to what M&G's customers do with the PoliProtect products. (D.I. 266 at 39) In particular, it asserts that the testimony of Invista's expert, Dr. Turner, was based on his belief and not any firsthand knowledge of facts because he was not privy to customer interactions with M&G. (*Id.*) (citing D.I. 267, ex. E at 140:24-144:11)

The only reasonable inference from the evidence of record is that M&G's customers mix the components of the pellets into blends to make their desired articles.⁸

⁸Accordingly, third parties also practice the "article" limitation of dependent claims 12 of the '216 patent, wherein "said article is a preform or a container."

In the absence of any contrary evidence, the court finds that M&G has not raised a genuine issue of material fact as to whether its customers mix the components of the PoliProtect products together, and thereby necessarily practice the “composition” limitation.

Having determined that M&G’s customers practice the “composition” limitation, the court next determines whether there is actual infringement of the remaining limitations of the ‘216 patent. As a threshold matter, M&G asserts that Invista cannot rely on M&G’s core technical documents to prove the contents of the PoliProtect products. (*Id.* at 25-27; D.I. 315 at 7-8) The court has addressed this argument, which M&G raised for the first time on summary judgment briefing, in a separate memorandum order and has found that M&G’s argument is impermissible as untimely and prejudicial. Therefore, Invista’s reliance on M&G’s core technical documents for the components of the PoliProtect products is appropriate, with the exception of arguments relating to specifics of the manufacturing process that M&G timely disclosed. (See, e.g., D.I. 237 at PA160-62, PA165-66) As M&G confirmed to the court, its non-infringement defenses are premised on its proposed claim construction. (*Id.* at PA426-27)

a. “Partially aromatic polyamide”

The parties agree that “partially aromatic polyamide” means “a polyamide that contains at least one aromatic ring and a non-aromatic species in the polymeric backbone.” (D.I. 209) M&G does not contest that MXD6, Mitsubishi 6007 Nylon, or Ultramid X17 Nylon, found in the core of the PoliProtect products, is a “partially

aromatic polyamide" under the parties' agreed construction. (See D.I. 232 at 29; D.I. 266) Specifically, the core technical documents reflect that PoliProtect APB contains between 4.9 and 5.1 weight % Ultramid X17 Nylon, and PoliProtect JB contains between 2.4 to 3.4 weight % Mitsubishi 6007 Nylon or Ultramid X17 Nylon. (D.I. 237 at PA255, PA259) As M&G offers no evidence to the contrary, the PoliProtect products also practice dependent claim 2 of the '216 patent, which requires partially aromatic polyamide "present in a range from about 1 to about 10 wt. %." In addition, M&G does not dispute that MXD6 is a meta-xylylene adipamide (see D.I. 266 at 3), as required by dependent claim 5 of the '216 patent. Finally, there is no dispute that the metal sulfonate salt (as identified *infra*) of the PoliProtect products is attached to sulfoisophthalic acid, which is one of the recited aromatic acid nuclei recited by dependent claim 9. Accordingly, the court finds that the PoliProtect products practice the "partially aromatic polyamide" limitation of all asserted claims of the '216 patent.

b. "Metal sulfonate salt"

According to the core technical documents and Dr. Moore's expert opinions, the PoliProtect products contain lithium sulfoisophthalic acid ("LiSIPA"). (See, e.g., D.I. 237 at PA153, PA155, PA161, PA248, PA250, PA255, PA259) M&G's non-infringement argument for the "metal sulfonate salt" limitation relies on its construction that a "metal sulfonate salt" cannot contain a lithium salt.⁹ The court, however, has not embraced

⁹Dr. Moore, in his expert reports, also avers that LiSIPA, by itself (i.e., "in its monomer form"), cannot be the "ionic compatibilizer" limitation of the '159 patent. (D.I. 237 at PA155-60) However, he does not opine that it cannot be the "metal sulfonate salt" limitation of the '216 patent under the court's construction. (See D.I. 237 at PA164-67)

M&G's proposed construction for this limitation and has instead construed "metal sulfonate salt" to be "a salt of sulfonic acid wherein the cation is a metal ion." Dr. Moore concedes that lithium is the metal ion in LiSIPA, and there remains no material dispute of fact that LiSIPA is a "metal sulfonate salt," as construed by the court. (See *id.* at PA166)

The PoliProtect products also meet dependent claim 3 of the '216 patent, which recites metal sulfonate salt "present in a range from about 0.1 to about 2.0 mole %" because the core technical documents indicate that PoliProtect APB contains 0.4 mole % LiSIPA functional groups and that PoliProtect JB contains 0.28 mole % LiSIPA functional groups; M&G offers no evidence to the contrary. (See *id.* at PA248, PA250) Moreover, because it is not disputed that the metal ion in LiSIPA is lithium, the PoliProtect products also practice dependent claim 8 of the '216 patent, which recites a group of metal ions, including Li⁺. Therefore, there is no genuine issue of material fact, under the court's claim construction, that the LiSIPA in the PoliProtect products meet the "metal sulfonate salt" limitation of all the asserted claims of the '216 patent.

c. "Copolyester comprising a metal sulfonate salt"

The court has construed "copolyester comprising a metal sulfonate salt" to mean "a copolyester including, but not limited to, a metal sulfonate salt." There is no dispute that the outer layer of the PoliProtect products is made of a copolyester with, among other things, LiSIPA, which is a metal sulfonate salt.¹⁰ (See D.I. 266 at 19) M&G has

¹⁰Specifically, the copolyester is EG/DEG-TPA/IPA/LiSIPA copolyester, or a copolyester synthesized from the monomers ethylene glycol, diethylene glycol, terephthalic acid, isophthalic acid, and bis(2-hydroxyethyl) 5-lithiosulfoisophthalate. (See D.I. 237 at PA29, PA255, PA259; D.I. 266 at 19)

not asserted any non-infringement argument under a construction that does not require the metal sulfonate salt to be unattached from the copolyester or roaming freely in the mixture. (See *id.* at 27-28; D.I. 237 at PA166-67) Accordingly, there is no genuine issue of material fact that the copolyester with LiSIPA (the “LiSIPA-containing copolyester”) in the PoliProtect products meets the “copolyester comprising a metal sulfonate salt” limitation.

d. “Cobalt salt”

The parties do not dispute that cobalt neodeconate is added during the manufacturing process of the PoliProtect products. (D.I. 237 at PA248, PA250, PA255, PA259; D.I. 266 at 19-20) M&G’s proposed construction for “cobalt salt” would have limited a “cobalt salt” to four specific cobalt salts and excluded cobalt neodeconate. (See D.I. 209) The court has not embraced M&G’s proposed construction and has construed “cobalt salt” to be “a salt wherein the cation is cobalt.” Under this construction, there is no genuine dispute of fact that cobalt neodeconate is a “cobalt salt.” (See D.I. 237 at PA33-34; D.I. 266 at 20)

M&G argues that at no time during or after the manufacturing process does the cobalt neodeconate exist together with the copolyester and partially aromatic polyamide components. (D.I. 266 at 20) Specifically, Dr. Moore avers in his expert report that, after the cobalt neodeconate salt is added during manufacturing (and before the partially aromatic polyamide is added), the cobalt neodeconate complexes with the copolyester such that it no longer exists separately in the mixture. (D.I. 237 at PA166) However, even if true, Dr. Moore testified at his deposition that he has no opinion

regarding whether **all** of the cobalt neodeconate complexes:

Q. Is it your opinion that when cobalt salt is added to the PoliProtect [products], all of the cobalt salt complexes with the copolyester?

A. I've never tested the complexation of the cobalt salt to the copolyester, so I can't speculate on that.

Q. So you don't have an opinion as to whether all the cobalt salt complexes with the copolyester or not in the M&G products?

A. I don't have an opinion about the cobalt – all of the cobalt salt being complexed.

Q. Is it your opinion that some of the cobalt salt is complexed?

A. It's my opinion that could be quite likely.

Q. Do you know how much of the cobalt salt is complexed?

A. I have not tested that.

(*Id.* at PA514-15 129:22-130:15)

Essentially, Dr. Moore has testified that he cannot tell how much cobalt neodeconate is left in the PoliProtect products. As there is no dispute that cobalt neodeconate is added as an ingredient, M&G has no evidence that could lead a reasonable jury to conclude that there is not at least some trace amount of cobalt salt left in the final PoliProtect products, even if some of it complexes. Therefore, the "cobalt salt" limitation of independent claim 1 is met.

On the other hand, a material issue of fact remains regarding infringement of claim 4 of the '216 patent, which recites a limitation wherein the cobalt salt is present in the range of about 20 to about 500 ppm. The only documentary evidence regarding the composition of the PoliProtect products shows that 115 to 125 ppm of cobalt

neodeconate is added to make PoliProtect APB and that 88 to 108 ppm of cobalt neodeconate is added to make PoliProtect JB. (See *id.* at PA255, PA259) In light of Dr. Moore's opinion that it is probable that some amount of the cobalt neodeconate reacts, the court finds that there remains a genuine issue of material fact regarding whether at least about 20 ppm of cobalt neodeconate is left in the PoliProtect products.

In sum, the court finds actual infringement by M&G's customers of all asserted claims¹¹ of the '216 patent except claim 4, which recites a range of cobalt salt.

e. Contributory infringement

With respect to contributory infringement under 35 U.S.C. § 271(c), Invista must demonstrate that M&G sells "a component of a patented machine . . . knowing the same to be especially made or especially adapted for use in an infringement of such patent, and not a staple article or commodity of commerce suitable for substantial noninfringing use."¹² *Golden Blount*, 365 F.3d at 1061 (internal quotation marks omitted). The parties do not dispute that M&G had knowledge of the '216 patent at least from the filing of this lawsuit.¹³

With respect to no substantial noninfringing use, Invista argues that M&G's core

¹¹Specifically, claims 1-3, 5, 8, 9, and 12 of the '216 patent.

¹²Intent to cause infringement is not a requirement of contributory infringement under 35 U.S.C. § 271(c). See *Hewlett-Packard Co. v. Bausch Lomb Inc.*, 909 F.2d 1464, 1469 (Fed. Cir. 1990) ("Section 271(c) . . . made clear that only proof of a defendant's knowledge, not intent, that his activity cause infringement was necessary to establish contributory infringement.").

¹³Invista points to internal M&G communications to assert that M&G also had knowledge of the patents-in-suit before the suit was filed, but it is not moving for summary judgment of indirect infringement based on M&G's alleged pre-suit knowledge. (D.I. 232 at 15-16, 35 & n.29)

technical documents describe only one use – making food and beverage containers – for the PoliProtect products: the “PoliProtect [products] [are] designed to provide highly desirable container properties” (D.I. 237 at PA251, PA264); the “PoliProtect [products] [are] suitable for the manufacture of articles for numerous food packaging applications.”¹⁴ (*Id.* at PA252, PA265) Invista contends that the bilayer feature of the PoliProtect products, touted in marketing materials, is specifically targeted to making preforms or bottles. The bilayer technology simplifies the article-production process by combining the components into one product that can be fed into the injection molding machine, which mixes the components together. (See *id.* at PA439 111:11-113:2, PA454 87:8-12, PA455 88:5-9) In addition, an M&G powerpoint illustrates that the bi-layer feature allows the PoliProtect products’ “[b]arrier [to become] active only when bottles are blown” (*Id.* at PA381) Thus, the PoliProtect products are designed with the intent that the components in the two layers be mixed together such that the inner layer “activates” the barrier of the outer layer. According to the evidence, this is the only way for the active barrier of the PoliProtect products to be activated.

M&G offers no evidence to rebut Invista’s arguments that the PoliProtect products are **not** staple articles of commerce that are suitable for noninfringing uses.¹⁵

¹⁴An M&G powerpoint also states that PoliProtect APB “guarantees a high active barrier associated with the necessary passive barrier for the following applications: Juices, smoothies, juice based products, [b]eer, wine, [m]ilk and dairy products, [and] [f]ood applications (ketchup, salad dressing, etc . . .)” and that PoliProtect JB “suits particularly products that need medium active barrier: [j]uices, smoothies, fruit based beverages, and [f]ood applications (ketchup, salad dressing, etc . . .).” (D.I. 237 at PA284)

¹⁵M&G only argues that Invista’s assertions are conclusory. (See D.I. 266 at 40) The court finds that Invista’s assertions are supported by citations to the record.

(D.I. 266 at 40-41) Therefore, there is no genuine issue of material fact as to whether the only “practical or worthwhile” use of the PoliProtect products is for them to be melted and made into articles, such as preforms, bottles, or containers. See *i4i Ltd. P'ship v. Microsoft Corp.*, 598 F.3d 831, 851 (Fed. Cir. 2010).

f. Active inducement of infringement

M&G may be liable for induced infringement under 35 U.S.C. § 271(b) if it had specific intent to cause infringement of the ‘216 patent by the manner in which the PoliProtect products are used. *Ricoh Co. v. Quanta Computer Inc.*, 550 F.3d 1325, 1340, 1343 (Fed. Cir. 2008). “[S]pecific intent may be inferred from circumstantial evidence where a defendant has both knowledge of the patent and specific intent to cause the acts constituting infringement.” See *id.* at 1342. The Federal Circuit has recognized that “providing instruction on how to engage in an infringing use ‘show[s] an affirmative intent that the product be used to infringe.’” *Id.* at 1343 (quoting *Metro-Goldwyn-Mayer Studios, Inc. v. Grokster, Ltd.*, 545 U.S. 913, 936 (2005)) (alteration in original).

There can be no dispute that M&G knew about the ‘216 patent no later than the filing of this suit. In addition, M&G advertised an infringing use, in the sense that the bilayer feature of the PoliProtect products is only advantageous when the layers are mixed. As discussed, Invista has established on the summary judgment record that the PoliProtect products have no substantial noninfringing use. “While selling a potentially infringing product where each component part thereof has a substantial lawful use may well be ‘equivocal,’ it is entirely appropriate to presume that one who sells a product

containing a component that has no substantial noninfringing use in that product does so with intent that the component will be used to infringe." *Ricoh*, 550 F.3d at 1338. Therefore, Invista has demonstrated on summary judgment that M&G had specific intent to cause infringement at least after the filing of this lawsuit.

g. Conclusion regarding indirect infringement of the '216 patent

In light of the foregoing, the court finds that Invista has sufficiently established both induced infringement and contributory infringement of claims 1-3, 5, 8, 9, and 12 of the '216 patent for the time period following commencement of this suit. The court grants Invista's motion for summary judgment of infringement in this regard.

3. Indirect infringement of the '159 patent

In contrast, the court does not enter summary judgment regarding indirect infringement of the '159 patent because whether the PoliProtect products practice the "polyester" limitation of the '159 patent remains a disputed question of fact. Invista's argument for literal infringement of that limitation is based on the LiSIPA-containing copolyester of the PoliProtect products meeting both the "polyester" and "ionic compatibilizer" limitations of the '159 patent. M&G does not dispute that the LiSIPA-containing copolyester in the PoliProtect products meet the "ionic compatibilizer" limitation of the '159 patent. (See D.I. 232 at 10, 13) The court's construction of "polyester," however, requires the "polyester" and "ionic compatibilizer" components to be separate and distinct. Under this construction, the LiSIPA-containing copolyester of the PoliProtect products cannot also literally practice the "polyester" limitation.

Invista's expert, Dr. Turner, opines that the LiSIPA-containing copolyester of the

PoliProtect products still meets the “polyester” limitation of the ‘159 patent under the doctrine of equivalents. Specifically, he opines that combining a LiSIPA-containing copolyester (an “ionic compatibilizer”) and a base polymer (a “polyester”) forms the same copolymer as the LiSIPA-containing copolyester of the PoliProtect products. (D.I. 237 at PA55) Therefore, Dr. Turner asserts that the LiSIPA-containing copolyester of the PoliProtect products is insubstantially different and performs the same function as the separate and distinct “polyester” and “ionic compatibilizer” components.

M&G argues that Invista is simply trying to overcome the fact that an element is literally missing from the PoliProtect products. (D.I. 232 at 29) However, the Federal Circuit has held that the doctrine of equivalents may be applicable even when its application would vitiate the requirement that two components be separate elements.

Brilliant Instruments, Inc. v. GuideTech, LLC, 707 F.3d 1342, 1346-47 (Fed. Cir. 2013).

Rather, to find infringement under the doctrine of equivalents, any differences between the claimed invention and the accused product must be insubstantial. *Graver Tank & Mfg. Co. v. Linde Air Prods. Co.*, 339 U.S. 605, 608 (1950). “One way of proving

infringement under the doctrine of equivalents is to show, for each claim limitation, that the accused product ‘performs substantially the same function in substantially the same way with substantially the same result as each claim limitation of the patented product.’

This is a question of fact.” *Brilliant Instruments*, 707 F.3d at 1347 (citing *Crown*

Packaging Tech., Inc. v. Rexam Beverage Can Co., 559 F.3d 1308, 1312 (Fed. Cir.

2009)).

Invista offers expert testimony that the differences between the claimed invention

of the '159 patent and the PoliProtect products are insubstantial, while M&G offers testimony that they are not insubstantially different. The court finds that Invista has raised a genuine issue of material fact under the doctrine of equivalents regarding the "polyester" limitation of the '159 patent, thus precluding summary judgment of indirect infringement of the '159 patent.

4. Indirect infringement of the '930 patent

With respect to the '930 patent, M&G moves for summary judgment of no indirect infringement, based on three arguments.¹⁶ First, it avers that Invista has no evidence that the PoliProtect products include the requisite "base polymer." (D.I. 266 at 33-34) Second, M&G finds fault with Invista's evidence that the PoliProtect products meet the "catalyst deactivation factor of less than 0.25" limitation. Third, M&G asserts that Invista offers no evidence that M&G adds a colorant to the "final" PoliProtect products. (*Id.* at 36-37) For the reasons below, the court finds that questions of fact preclude the entry of summary judgment of no indirect infringement of the '930 patent.

(1) "A base polymer"

The court has found that no construction of "a base polymer" is required. Specifically, the court declined to adopt M&G's proposed construction that "a base polymer" must not contain an ionic compatibilizer. As M&G's non-infringement argument for this limitation depends on the court's adoption of its proposed limitation (see *id.* at 33-34), it raises no genuine issue of material fact, under the court's construction, that the LiSIPA-containing polyester component of the PoliProtect

¹⁶Invista does not move for summary judgment of indirect infringement of the '930 patent. (See D.I. 232)

products meets the “base polymer” limitation of the ‘930 patent.

(2) “Catalyst deactivation factor of less than 0.25”

Furthermore, M&G argues that Invista did not conduct testing on the PoliProtect products to determine if they meet the CDF limitation of the ‘930 patent and that the evidence that Invista offers regarding the limitation is not admissible. (*Id.* at 34-36) Invista supports its accusation that the PoliProtect products have a CDF that is less than 0.25 by offering Dr. Turner’s calculation of CDF from oxygen permeation tests for bottles made with PolyShield® resin (which is an Invista product), PET, MXD6, and a colorant called PolyOne Amber 64743. (D.I. 298 at 25) Dr. Turner’s testing found that bottles made with PolyShield®, MXD6, and PolyOne Amber 64743 had a permeation rate of 0.005 cm³/m²/day/bar, compared to 4.43333 cm³/m²/day/bar for bottles made with PET and MXD6.¹⁷ (D.I. 237 at PA111 ¶ 419) Applying the definition of CDF that is taught in the ‘930 patent and that the parties have agreed upon, Dr. Turner found that the CDF was 0.001. (*Id.* at PA110-11 ¶¶ 417, 419) He then opined that “[b]ecause PoliProtect has the same composition as PolyShield, for all relevant purposes, and any differences between the products would not impact the catalyst deactivation factor, [the] PoliProtect [products] also will have a catalyst deactivation factor of 0.001, which is less than 0.25, when Poly[O]ne Amber 64743 is added.” (*Id.* at PA111 ¶ 420) Dr. Turner

¹⁷Dr. Turner’s report referred to the 4.3333 cm³/m²/day/bar oxygen permeability rate of bottles made with “PolyShield and MXD6” for the denominator of the CDF calculation. (D.I. 237 at PA111 ¶ 419) However, as Invista points out, Dr. Turner’s reference seems to have been an inadvertent error. (D.I. 298 at 26) The source document that Dr. Turner cites to shows that the 4.43333 cm³/m²/day/bar oxygen permeability rate was taken from a bottle made with PET, not PolyShield®, and 5% weight MXD6 passive barrier sample. (See D.I. 299 at PA 676)

also opined that he used PolyOne Amber 64743 in his testing because that colorant is on a 2011 list of M&G's approved colorants for use with the PoliProtect products. (*Id.* at PA111-12 ¶¶ 416, 420)

M&G argues that Dr. Turner's methodology for calculating the CDF was improper because it compares Invista's commercial product (PolyShield®), rather than M&G's PoliProtect products, to the claims of the '930 patent. (D.I. 266 at 35-36) Given Dr. Turner's opinion that the CDF value he found was applicable to the PoliProtect products,¹⁸ his analysis and testimony constitutes circumstantial evidence for comparing the PoliProtect products to the claims of the '930 patent. Contrary to M&G's assertions, such evidence is probative of infringement and would be appropriate for the fact-finder to weigh.

M&G further asserts that Invista's theory that the PoliProtect products meet the CDF limitation of the '930 patent inappropriately relies on Fibox testing. (*Id.* at 34-35) M&G avers, and Invista does not dispute, that Fibox testing measures oxygen concentrations, not oxygen permeation rates. (*Id.* at 34; D.I. 298 at 26-27) However, Invista's expert, Dr. Turner, did not rely on any Fibox data in his CDF calculation. (See D.I. 237 at PA111-12 ¶¶ 418-23) He only stated that M&G uses Fibox testing to determine whether a colorant deactivates oxygen scavenging and that M&G's marketing materials indicate virtually no change in oxygen concentration after 100 hours, which indicates a very low oxygen permeation rate. (*Id.* at PA28 ¶ 75, PA44-45

¹⁸Based on the fact that the PoliProtect products had, for all relevant purposes, the same composition as PolyShield® and because PolyOne Amber 64743 is at least one of the colorants that M&G has allegedly approved for use with those products. (D.I. 237 at PA111-12 ¶¶ 416, 420)

¶ 124) In other words, Dr. Turner's opinions regarding how M&G used Fibox testing is entirely separate from the CDF testing that he points to as evidence that the PoliProtect products meet the CDF limitation of the '930 patent. Therefore, the court does not find that Dr. Turner's citation of Fibox data militates a summary judgment finding of no indirect infringement. Dr. Turner's opinions and evidence regarding the CDF limitation demonstrate that there are genuine issues of material fact regarding M&G's indirect infringement of the '930 patent.

(3) "Colorant"

Finally, M&G argues that Invista has no evidence that M&G adds colorants to the PoliProtect products. (D.I. 266 at 36-37) This argument is irrelevant because Invista alleges that M&G's **customers**, not M&G itself, add colorants to the PoliProtect products. (See D.I. 237 at PA43-46 ¶¶ 120-26; PA109-10 ¶¶ 411-14; D.I. 298 at 27-28)

In sum, Invista has offered evidence that creates genuine issues of material fact which preclude the entry of a summary judgment of no indirect infringement of the '930 patent. Invista has offered evidence that there is actual infringement of the "base polymer," "catalyst deactivation factor of less than 0.25," and "colorant" limitations. Therefore, the court denies M&G's motion for summary judgment in this regard.

B. Invalidity

M&G next moves for summary judgment of invalidity as to all asserted claims of the patents-in-suit. (D.I. 233) Specifically, it contends that the asserted claims of the '159 and '216 patents are invalid as being obvious and for failing to comply with the written description and enablement requirements of 35 U.S.C. § 112. (D.I. 234 at 9-34)

Invista cross-moves for partial summary judgment that all asserted claims of the '159 and '216 patents are not obvious and that those claims enable the use of metal sulfonate salts. (D.I. 263 at 52) Regarding the '930 patent, M&G argues that the asserted claims are invalid for failing to comply with the written description, enablement, and indefiniteness requirements of 35 U.S.C. § 112. (D.I. 234 at 34-39) Invista cross-moves for summary judgment that the asserted claims of the '930 patent are valid for satisfying those requirements of 35 U.S.C. § 112. (D.I. 263 at 52) For the reasons below, the court will deny M&G's motion and grant Invista's motion in part, insofar as M&G raises untimely theories of invalidity regarding the '159 and '216 patents.

1. The '159 and '216 patents

a. Obviousness

M&G asserts that the '159 and '216 patents are obvious in light of two prior art references: (1) PCT Publication No. WO 91/17925 ("the '925 reference"), titled "Container and a Process for Its Production" and published on November 28, 1991; and (2) a paper authored by Dr. Moore ("the Moore reference"), titled "Polyester Ionomers in Binary and Compatibilized Blends with Poly(Ethylene Terephthalate), Poly(Butylene Terephthalate) and Nylon 6,6" and published in 2001. (D.I. 234 at 8-9, 21-34) M&G contends that the two references, together, disclose all of the limitations of the '159 and '216 patents. (*Id.* at 21-32) It further asserts that one of ordinary skill in the art would have found it obvious to combine them. (*Id.* at 21-22, 33-34)

Invista contends that M&G's expert, Dr. Moore, never addressed the combination of the '925 and Moore references in his expert reports and that M&G disclosed its

obviousness argument based on this combination of references for the first time during summary judgment briefing, namely in its reply brief for invalidity. (See D.I. 263 at 16-20)

In his invalidity expert reports, Dr. Moore opined on anticipation by the '925 reference, but the only mention of the Moore reference was in an exhibit with 56 pages of possible prior art references for the '159 and '216 patents. (See D.I. 235, ex. I at 32; *see also id.*, ex. I at ex. C) Dr. Moore identified fourteen combinations of references in his obviousness analysis but did not address the combination of the '925 and Moore references. (*Id.*, ex. I at 31-37)

M&G's reply brief in support of its motion for summary judgment of invalidity (D.I. 303) does not respond to Invista's argument that M&G's argument is unsupported by expert testimony. Instead, M&G attempts to support its obviousness theory with new expert testimony submitted in a declaration ("Dr. Moore's new declaration") attached to its reply brief. (See D.I. 304) As explained in a separate memorandum order, however, the court has stricken, at Invista's request, the new opinions in Dr. Moore's new declaration for being an untimely and prejudicial supplementation.

Without the support of Dr. Moore's new declaration, M&G's obviousness argument is unsupported by expert testimony. Although M&G cites sections 6.3 and 6.5 of Dr. Moore's opening report and section 7.5 of his reply report, those sections discuss the '925 reference without mentioning the Moore reference. (See D.I. 235, ex. I; D.I. 236, ex. K) M&G's other citations are to generic language and the long disclosure of various possible prior art references in Dr. Moore's expert reports. M&G also includes a table in its opening brief which compares each claim limitation to the

'925 and Moore references (D.I. 234 at 23-32), but that table had never been previously disclosed to Invista either. (D.I. 263 at 18)

Therefore, M&G has no expert testimony regarding the combination of the '925 and Moore references. M&G tries to remedy this deficiency by repeatedly asserting that the '925 and Moore references are "simple pieces of prior art directed to barrier resins." (D.I. 234 at 21; D.I. 303 at 3) However, the field of polymer chemistry is a complex area of technology, and where patent claims involve complex issues of technology, expert testimony is required to aid the fact finder. See *Proveris Scientific Corp. v. Innovasystems, Inc.*, 536 F.3d 1256, 1267-68 (Fed. Cir. 2008); *Allergan, Inc. v. Barr Labs., Inc.*, 808 F. Supp. 2d 715, 735-36 & n.21 (D. Del. 2011), aff'd, 501 F. App'x 965 (Fed. Cir. 2013). Without expert testimony that the combination of the '925 and Moore references was obvious, M&G cannot carry its burden of clear and convincing evidence for obviousness. Therefore, the court grants Invista's motion for partial summary judgment of validity on this ground.

b. Lack of written description and non-enablement

(1) Lack of enablement of the metal sulfonate salts

M&G also moves for summary judgment of invalidity on grounds of non-enablement because the inventors of the '159 and '216 patents "did not provide any meaningful disclosures, teachings, or supportive data" in the specification for metal sulfonate salts besides sodium (Na⁺) and zinc (Zn⁺⁺). (D.I. 234 at 18) The asserted independent claims of the '159 and '216 patents recite the "metal sulfonate salt" limitation, which the court has construed to mean "a salt of sulfonic acid wherein the

cation is a metal ion." Asserted dependent claims 9 and 21 of the '159 patent and dependent claim 8 of the '216 patent recite the specific metal sulfonate salts Na⁺, Li⁺, K⁺, Zn⁺⁺, Mn⁺⁺, and Ca⁺⁺. Although the specification states that "[t]he metal ion of the sulfonate salt may be Na⁺, Li⁺, K⁺, Zn⁺⁺, Mn⁺⁺, Ca⁺⁺ and the like" ('216 patent, col. 4:65-67), M&G argues that the specification only discloses test data for the Na⁺ and Zn⁺⁺ metal ions. (See, e.g., *id.*, col. 10:62-11:12) In addition, M&G avers that the inventors could not confirm that they tested any metal ions other than Na⁺ and Zn⁺⁺ and that there is a substantial difference in using Li⁺ rather than Na⁺ or Zn⁺⁺ ions.¹⁹ (D.I. 234 at 18-19) (citing D.I. 236, ex. R at 20:8-21:3, ex. S at 46:9-47:2, ex. T at 24:19-26:4, 79:13-20; D.I. 237 at PA153 n.4)

As a threshold issue, Invista avers that M&G, again, never presented this defense in its invalidity contentions or expert reports. (D.I. 263 at 35) The court finds otherwise, as Invista was on notice of M&G's position with respect to the metal sulfonate salts no later than the claim construction briefing. During claim construction, M&G asserted that the "metal sulfonate salt" limitation should be limited to only the Na⁺ and Zn⁺⁺ ions for substantially the same reasons it proffers for its non-enablement argument. In particular, it argued that the disclosure of only Na⁺ and Zn⁺⁺ was insufficient and that "a person reviewing the intrinsic record would not understand that the inventors had made a generic invention that applied to all metals." (D.I. 230 at 14-

¹⁹M&G cited to Dr. Moore's opening invalidity report for its assertion that there is a substantial difference in using Li⁺ rather than Na⁺ or Zn⁺⁺. (See D.I. 234 at 18) (citing D.I. 235, ex. I at 24 n.4) However, as Invista notes, M&G appears to have meant to cite to Dr. Moore's non-infringement report. (See D.I. 263 at 33 n.18; see also D.I. 237 at PA153 n.4)

16) Therefore, the court does not find that M&G has waived its right to this defense.

The enablement requirement is a question of law based on underlying facts.

See *Sitrick*, 516 F.3d at 999. To satisfy this requirement, a patent's specification does not necessarily have to describe how to make and use every possible variant of the claimed invention because "the artisan's knowledge of the prior art and routine experimentation can often fill gaps, interpolate between embodiments, and perhaps even extrapolate beyond the disclosed embodiments, depending upon the predictability of the art." *AK Steel*, 344 F.3d at 1244; see also *Chiron*, 363 F.3d at 1253.

Invista has rebutted M&G's evidence with Dr. Turner's expert opinion that the '159 and '216 patent specification enables one of ordinary skill in the art to make and use the claimed invention. (D.I. 235, ex. J at 130-31) The weight of such evidence is properly weighed by the fact finder. The court finds that there remain underlying issues of material fact regarding whether the '159 and '216 patents enable one of ordinary skill in the art to make and use the claim invention without undue experimentation.

(2) Failure to disclose NaAC as an essential component

According to M&G, "[t]he most egregious deficiency" is Invista's failure to disclose in the specification the importance of sodium acetate ("NaAc") in controlling yellowness in the compositions of the '159 and '216 patents. (D.I. 234 at 10) As a result, M&G argues, the '159 and '216 patents are invalid for lack of written description and non-enablement. To support its argument, M&G submits testing conducted by Dr. Moore that allegedly confirms the importance of NaAc as a component; expert testimony that a person of ordinary skill in the art would not know to use NaAc or the

proper amount of NaAc; and internal Invista documents that purportedly show that Invista knew the importance of NaAc. (*Id.* at 11-18)

The enablement and written description requirements are both based on the invention **as claimed**. The written description requirement “serves both to satisfy the inventor’s obligation to disclose the technologic knowledge upon which the patent is based, and to demonstrate that the patentee was in possession of the invention that is claimed.” *Capon v. Eshhar*, 418 F.3d 1349 (Fed. Cir. 2005); see also *Vas-Cath Inc. v. Mahurkar*, 935 F.2d 1555, 1564 (Fed. Cir. 1991) (“The invention is, for purposes of the ‘written description’ inquiry, **whatever is now claimed**.”); MPEP § 2163 (“To satisfy the written description requirement, a patent specification must describe the claimed invention in sufficient detail that one skilled in the art can reasonably conclude that the inventor had possession of the claimed invention.”). Similarly, “[a]s the Federal Circuit has explained, it is the claimed invention for which enablement is required. The applicant is not required to include in his application support for matters not set forth in the claim.” *Phillips Petroleum Co. v. U.S. Steel Corp.*, 673 F. Supp. 1278, 1292 (D. Del. 1987) (citing *W.L. Gore & Assocs., Inc. v. Garlock, Inc.*, 721 F.2d 1540, 1557 (Fed. Cir. 1983), *cert. denied*, 469 U.S. 851 (1984); *DeGeorge v. Bernier*, 768 F.2d 1318, 1323 (Fed. Cir. 1985)); see also *Liquid Dynamics Corp. v. Vaughan Co., Inc.*, 449 F.3d 1209, 1224 & n.2 (Fed. Cir. 2006) (noting that the enablement requirement “necessarily depends on an interpretation of the claims”); MPEP § 2164.08 (“The invention that one skilled in the art must be enabled to make and use is that defined by the claim(s) of the particular application or patent.”).

M&G does not genuinely dispute that the specification of the '159 and '216 patents enable one of skill in the art to make the compositions as claimed. In fact, M&G's own expert, Dr. Moore, conceded that a person of ordinary skill in the art would know how to make a composition for containers comprising the components as claimed in the '159 and '216 patents. (D.I. 264 at PA616-17 293:13-295:1) He qualified his testimony by opining that one would have to do an extensive amount of experimentation to figure out how to make a mixture for a non-yellow bottle, but only pointed to non-asserted claim 26 of the '159 patent as having any non-yellowness requirement.²⁰ (*Id.* at PA617 295:1-18)

Here, NaAc is not a limitation in any of the asserted claims and is not mentioned in the specification. Unexpected synergistic improvement in yellowness and haze is discussed in the specification as one of the improvements over the prior art ('216 patent, col. 2:55-61), but is not a limitation in any of the asserted claims. Moreover, the specification does not teach that NaAc is an essential ingredient to the claimed inventions. As the MPEP provides:

[A]n enablement rejection based on the grounds that a disclosed critical limitation is missing from a claim should be made only when the language of the specification makes it clear that the limitation is critical for the invention to function as intended. Broad language in the disclosure, including the abstract, omitting an allegedly critical feature, tends to rebut the argument of criticality.

MPEP § 2164.08(c).

Therefore, in light of the inventions recited in the asserted claims, M&G's

²⁰Claim 14 of the '216 patent also recites a yellowness limitation, but that claim is not being asserted in this action.

arguments that the '159 and '216 patents are invalid for the inventors' alleged failure to disclose the presence of NaAc is irrelevant to the written description and enablement requirements. The enablement and written description requirements "usually rise and fall together" because "a recitation of how to make and use the invention across the full breadth of the claim is ordinarily sufficient to demonstrate that the inventor possesses the full scope of the invention, and vice versa." *LizardTech, Inc. v. Earth Res. Mapping*, 424 F.3d 1336, 1344-45 (Fed. Cir. 2005). Accordingly, the court grants Invista's partial motion for summary judgment of validity on this ground.

(3) Other grounds under 35 U.S.C. § 112

In addition to the alleged deficiencies discussed above, M&G asserts numerous other deficiencies in the '159 and '216 patents, including failures to disclose that:

1) two different types of cobalt were used in each run which states that 200 ppm cobalt was used, not a single type of cobalt, as reported; 2) sometimes the cobalt was added during polymerization, it was not always added as a masterbatch, as reported; 3) Run Nos. 3 and 4 were actually resin C, not [r]esin D, as reported; 4) Run Nos. 5 and 6 were not made from the same base resin as Run Nos. 7 and 8, as reported; 5) Run No. 8 used a low molecular weight nylon and did not use the same type of nylon/MXD6 as the other runs that used nylon, as reported; 6) the re-runs of data for Table 7 [of the specification] was [sic] not faithfully reproduced because even some of the non-SIPA runs still had SIPA and NaAc, when they originally did not, as reported to the PTO; 7) whether the ester or glycolate of SIPA was used; 8) the amounts, or definite presence, of: manganese acetate, zinc acetate, cobalt acetate, antimony trioxide, and poly-phosphoric acid; 9) final values for the amount of MXD6, which can vary above and below the projected amount, as reported; 10) what kind or amount of reheat agent used; and 11) generally, for each active ingredient, when they are added to one another, and the timing and temperatures for those additions, and what amounts or ratios of each ingredient is needed.

(D.I. 234 at 19-20) Underlying all of these arguments is the theory that the scope of the

asserted claims is “substantially broader than the small number of examples provided,” such that the ‘159 and ‘216 patents improperly claim all combinations of known components. (D.I. 235, ex. I at 43) M&G relies on Dr. Moore’s expert reports, in which he concludes that “the claim inventions are not described with sufficient detail to enable one skilled in this unpredictable art to make and use the same without undue experimentation.” (*Id.*; see also D.I. 236, ex. K at 38-44)

Dr. Turner disagrees with Dr. Moore’s testimony and asserts that a person of ordinary skill in the art would understand that the examples provided in the ‘159 and ‘216 patents are illustrative of the broader claimed inventions and a person of ordinary skill would be able to make the claimed inventions in light of the disclosures. (D.I. 235, ex. J at 130-31) In light of the conflicting expert testimony, the court finds that these issues present genuine questions of material fact that preclude summary judgment.

2. The ‘930 patent

With respect to the ‘930 patent, M&G moves for summary judgment of invalidity based on lack of written description, non-enablement, and indefiniteness. Specifically, M&G asserts various reasons on summary judgment why a person of ordinary skill, following the disclosure of the ‘930 patent, would not be able to: (1) conclude that the inventors had possession of the full scope of the claimed invention; (2) practice the claimed invention without undue experimentation; or (3) determine what the claims cover or whether a particular composition infringes (See D.I. 234 at 39)

First, M&G points to the testimony of its expert, Dr. Moore, who asserts that the CDF value, as taught in the ‘930 patent, relies on the measurement of the Apparent

Permeation Coefficient (“APC”) and three references provided in the ‘930 patent, but that the APC term does not appear anywhere in those three references. (D.I. 235, ex. I at 54-55; see also ‘930 patent, col. 6:37-57) Invista’s expert, Dr. Turner, opines that the references cited in the ‘930 patent are irrelevant to a person of ordinary skill’s understanding of the APC. (D.I. 235, ex. J at 133-34) He further opines that the ‘930 patent’s specification sufficiently teaches one of ordinary skill in the art how to calculate oxygen permeability and CDF values. (*Id.*)

Second, Dr. Moore opines that, during prosecution, the patentee “asserted that th[e] amount of [catalyst] deactivation . . . is not related to the chemical type of colorant by **comparing only two colorants**, with purportedly similar chemical types . . . but which had very different CDFs.” (*Id.*, ex. I at 55) The patentee then asserted that resins with colorants whose binding energy differed from the control by less than 0.307% did not have their transition metal catalysts deactivated, which Dr. Moore claims was an arbitrary limit in the CDF value from the “speculative coincidence of a few select examples.” (*Id.*) As a result, Dr. Moore avers, the ‘930 patent reports no supported correlation between CDF and the type of colorant, rendering the asserted claims invalid for lack enablement or adequate written description. (*Id.*) Dr. Turner disagrees with Dr. Moore’s assertion that the patentee based its conclusion on only two colorants and points to table 1 of the ‘930 patent as disclosing various colorants with various CDF values, some of which are identified as being the same “colorant type.” (*Id.*, ex. J at 134) In addition, Dr. Turner disagrees with Dr. Moore’s conclusion that the ‘930 patent reports no correlation between CDF and the type of colorant; rather, he

asserts that the '930 discloses to a person of ordinary skill how to identify, without undue experimentation, colorants which will not deactivate the oxidation catalyst. (*Id.*, ex. J at 136)

Third, M&G argues that the patentee withheld internal test data that was inconsistent with the CDF data presented to the PTO during patent prosecution. (D.I. 234 at 36) For example, the patentee allegedly misreported the size (or volume) of some of the bottles used in the tests; the timing (or age) at the time of permeability testing; and the colorant concentration levels. (*Id.* at 36-39) (citing D.I. 236, exs. X-Z) Invista responds by citing to Dr. Moore's deposition, in which Dr. Moore allegedly did not know where the data came from. (See D.I. 264 at PA617 296:22-297:24) Furthermore, Invista's expert, Dr. Turner, rebuts M&G's arguments by asserting that Dr. Moore's opinions are not based on sufficient supporting documentation, contain inconsistencies, and do not provide any analysis as to why any withheld or misreported data would render the asserted claims of the '930 patent invalid under 35 U.S.C. § 112. (D.I. 235, ex. J at 134-35)

As the parties rely on competing expert testimony regarding M&G's various 35 U.S.C. § 112 defenses, genuine issues of material fact remain for all of those issues. The court, therefore, denies the parties' motions for summary judgment of invalidity and validity of the '930 patent.

V. CONCLUSION

For the foregoing reasons, Invista's motion for partial summary judgment of infringement (D.I. 231) is granted in part and denied in part. It is granted with respect to

indirect infringement of claims 1-3, 5, 8, 9, and 12 of the '216 patent for the time period following commencement of this suit. M&G's cross-motion for summary judgment of non-infringement (D.I. 265) is granted in part and denied in part. The motion is granted with respect to no direct infringement of all asserted claims of the '159 and '216 patents.

Furthermore, M&G's motion for summary judgment of invalidity (D.I. 233) is denied, and Invista's cross-motion for partial summary judgment of validity (D.I. 262) is granted in part and denied in part. Invista's cross-motion is granted with respect to no invalidity of all asserted claims of the '159 and '216 patents on grounds of obviousness and failure to disclose NaAc.

An appropriate order shall issue.

IN THE UNITED STATES DISTRICT COURT
FOR THE DISTRICT OF DELAWARE

INVISTA NORTH AMERICA S.A.R.L.)
and AURIGA POLYMERS INC.,)
Plaintiffs,)
v.) Civ. No. 11-1007-SLR-CJB
M&G USA CORPORATION and M&G)
POLYMERS USA, LLC,)
Defendants.)

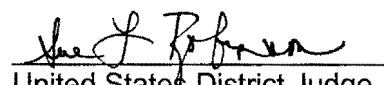
O R D E R

At Wilmington this 25th day of June, 2013, consistent with the memorandum opinion issued this same date;

IT IS ORDERED that:

1. Plaintiffs' motion for partial summary judgment of infringement (D.I. 231) is granted in part and denied in part. It is granted with respect to indirect infringement of claims 1-3, 5, 8, 9, and 12 of the '216 patent for the time period following commencement of this suit.
2. Defendants' cross-motion for summary judgment of non-infringement (D.I. 265) is granted in part and denied in part. The motion is granted with respect to no direct infringement of all asserted claims of the '159 and '216 patents.
3. Defendants' motion for summary judgment of invalidity (D.I. 233) is denied.
4. Plaintiffs' cross-motion for partial summary judgment of validity (D.I. 262) is granted in part and denied in part. The motion is granted with respect to no invalidity of

all asserted claims of the '159 and '216 patents on grounds of obviousness and failure to disclose sodium acetate.



United States District Judge

IN THE UNITED STATES DISTRICT COURT

FOR THE DISTRICT OF DELAWARE

INVISTA NORTH AMERICA S.À.R.L.)
and AURIGA POLYMERS INC.,)
)
Plaintiffs,)
)
v.) Civ. No. 11-1007-SLR-CJB
)
M&G USA CORPORATION and M&G)
POLYMERS USA, LLC,)
)
Defendants.)

MEMORANDUM ORDER

At Wilmington this 12th day of July, 2013, having reviewed the motion for reconsideration filed by defendants M&G USA Corporation and M&G Polymers USA, LLC (collectively, "M&G"), M&G's proffer as to Dr. Kevin Rollick's proposed testimony ("the proffer"), and the papers filed in connection therewith;

IT IS ORDERED that said motion (D.I. 404) is denied and the proffer (D.I. 403) is rejected, for the reasons that follow:

1. **Background.** Invista North America S.à.r.l. and Auriga Polymers Inc. (collectively, "Invista") filed this action against M&G for infringement of United States Patent Nos. 7,919,159 ("the '159 patent"), 7,943,216 ("the '216 patent"), and 7,879,930 ("the '930 patent") (collectively, "the patents-in-suit"). (D.I. 1; D.I. 7) The inventions of the patents-in-suit relate to plastic materials with applications in packaging for oxygen-sensitive foods and beverages.

2. **Motion for reconsideration.** The court issued a memorandum opinion and order dated June 25, 2013 that granted, in relevant part, Invista's motion for summary judgment of indirect infringement of asserted claims 1-3, 5, 8, 9, and 12 of the '216 patent. (D.I. 382, 383) The court found infringement by M&G customers when they melt the accused PoliProtect APB and JB products (collectively, "the PoliProtect products") and thereby mix the components together. (D.I. 382 at 19) The focus on reconsideration is the court's finding that the "cobalt salt" limitation of the '216 patent was met because cobalt neodecanoate is undeniably added during the manufacturing of the PoliProtect products and M&G had submitted no evidence to raise a genuine issue of material fact on summary judgment that it does not exist in the final PoliProtect products. (*Id.* at 24-26)

3. The purpose of a motion for reconsideration is to "correct manifest errors of law or fact or to present newly discovered evidence." *Max's Seafood Cafe ex rel. Lou-Ann, Inc. v. Quinteros*, 176 F.3d 669, 677 (3d Cir. 1999). Accordingly, a court may alter or amend its judgment if the movant demonstrates at least one of the following: (1) a change in the controlling law; (2) availability of new evidence not available when summary judgment was granted; or (3) a need to correct a clear error of law or fact or to prevent manifest injustice. See *id.* A motion for reconsideration is not properly grounded on a request that a court rethink a decision already made. See *Glendon Energy Co. v. Borough of Glendon*, 836 F. Supp. 1109, 1122 (E.D. Pa.1993). Motions for reargument or reconsideration may not be used "as a means to argue new facts or issues that inexcusably were not presented to the court in the matter previously decided." *Brambles USA, Inc. v. Blocker*, 735 F. Supp. 1239, 1240 (D. Del. 1990).

4. In its motion for reconsideration, filed July 3, 2013, M&G asserts that the court made an error not of reasoning but of misapprehension of fact and law. (D.I. 405 at 1) Specifically, M&G asserts that the court "misapprehended the facts supporting M&G's position" because Dr. Robert B. Moore's deposition testimony does not disavow his expert report. (*Id.* at 1, 6-8) It further asserts that the court improperly shifted the burden on infringement to M&G by requiring it to show that no cobalt neodecanoate exists in the PoliProtect products after complexing occurs. (*Id.* at 1, 5)

5. The court previously reviewed every citation to Dr. Moore's testimony that M&G now relies upon in its motion for reconsideration, and concluded that no reasonable juror could find that there is no cobalt salt in the accused PoliProtect products. Dr. Moore's opinion in his expert report regarding the complexing of cobalt neodecanoate was a general one which cited to a single Invista document regarding whether or not cobalt complexes.¹ (See D.I. 237 at PA166; see also *id.* at PA515 132:14-134:3) During his deposition, Dr. Moore admitted that he had no opinion as to whether **all** of the cobalt salt complexes in the PoliProtect products.² (See *id.* at PA515

¹Dr. Moore opined in his expert report that "[s]hortly after the cobalt salt is added, . . . the cobalt salt as added no longer exists." (D.I. 237 at PA166) He did not offer any explanation as to this conclusion but simply referred to a single Invista document. Dr. Moore testified during his deposition that the Invista document upon which he relied supported his conclusion that cobalt salt complexes, not that it complexes completely. (*Id.* at PA515 133:17-23)

²M&G attempts to characterize portions of Dr. Moore's deposition testimony as a reluctance to opine, as a matter of fact, that no cobalt neodecanoate exists in the PoliProtect products because he had not conducted any testing to determine the amount of complexing that takes place. (D.I. 405 at 2-4, 6) (citing D.I. 237 at PA515-16 134:4-134:20, 135:24-137:4) However, M&G does not acknowledge the preceding line of questioning to which Dr. Moore clearly responded, "I don't have an opinion about the cobalt – all of the cobalt salt being complexed." (See D.I. 237 at PA515 129:22-130:8)

130:4-8) M&G's attempt to create an opinion from an expert who has provided sworn testimony that he has no opinion on the relevant issue cannot sustain a motion for reconsideration or create any credibility issues for a jury.

6. Moreover, the court did not improperly shift the burden of infringement onto M&G. Throughout its analysis, the court did not waver from the principle that Invista carries the ultimate burden by a preponderance of the evidence. After Invista had shown a *prima facie* case for summary judgment, M&G bore the burden of production "to present specific evidence indicating there is a genuine issue for trial." *Air Turbine Tech., Inc. v. Atlas Copco AB*, 410 F.3d 701, 707-08 (Fed. Cir. 2005). Without any evidence to support its argument that all of the cobalt neodecanoate complexes out of the PoliProtect products, M&G failed to raise any genuine issue of material fact to preclude summary judgment.³

7. **The proffer.** M&G now avers that it should be permitted to offer testimony concerning Dr. Rollick's testing related to cobalt salt complexing. On February 10, 2012, M&G identified Dr. Rollick as a witness in its Rule 26 disclosures, and on March 27, 2013, it identified Dr. Rollick as a fact witness for trial. Invista deposed Dr. Rollick on May 29, 2013. There is no dispute that Dr. Rollick cannot testify at trial as an expert witness because he prepared no expert report, but M&G contends that he should be

³M&G's request for expedited briefing is denied as moot. Invista's request for attorney fees in connection with the motion for reconsideration (D.I. 415 at 10 n.9) is denied.

permitted to testify as a fact witness.⁴ In this regard, and at the court's request, M&G submitted the proffer. (D.I. 403)

8. According to the proffer, Dr. Rollick was employed by M&G and its predecessors and, from 1992 to 2010, worked on polyester resins for packaging applications. (*Id.* at ¶ 2) He was allegedly asked by his manager in 2008 to investigate the cause of an intense blue color observed when cobalt neodecanoate was added during the manufacturing process of the PoliProtect products. (*Id.* at ¶ 3) From investigations he conducted in 2008 and 2009 ("the 2008-09 experiments"), he determined that the color was attributable to the addition of lithium acetate, which converted cobalt neodecanoate to a new species, cobalt tetracarboxylate. (*Id.* at ¶ 4)

9. Dr. Rollick retired in November 2010, but was subsequently hired by M&G's patent prosecution counsel as a consultant to conduct testing in support of a pending patent application, Application No. 13,677,345 ("the '345 application"), on which he is listed as a co-inventor. (*Id.* at ¶ 7) Between December 2012 and May 2013, Dr. Rollick conducted additional experimentation ("the 2012-13 experiments"); M&G asserts that the 2012-13 experiments were aimed at merely reproducing the 2008-09 experiments. (*Id.* at ¶¶ 8-10) Dr. Rollick submitted data from the 2012-13 experiments, along with his opinions drawn from that data, as declarations to the United States Patent and Trademark Office ("PTO") between late 2012 and 2013. (*Id.* at ¶ 11)

10. Opinions based on "scientific, technical, or other specialized knowledge that will help the trier of fact to understand the evidence or to determine a fact in issue" are

⁴The court notes for the record that fact discovery closed on October 5, 2012, and expert discovery closed on February 20, 2013. (D.I. 18; D.I. 144)

reserved for expert witness testimony. Fed. R. Evid. 702. Under Federal Rule of Evidence 701:

If a witness is not testifying as an expert, testimony in the form of an opinion is limited to one that is: (a) rationally based on the perception of the witness, (b) helpful to a clear understanding of the witness' testimony or the determination of a fact in issue, and (c) **not based on scientific, technical, or other specialized knowledge**.

Fed. R. Evid. 701 (emphasis added).⁵

11. Having reviewed the proffer, the exhibits attached thereto, the documents that allegedly relate to Dr. Rollick's testing (see *id.* at ¶ 6), and Dr. Rollick's deposition, the court finds that none of the data include self-evident facts that cobalt neodecanoate complexes completely. Any opinions or inferences drawn from the data would clearly require scientific, technical, or other specialized knowledge. At the time Dr. Rollick conducted the 2008-09 experiments, he did not express any opinion regarding the extent to which cobalt neodecanoate complexes. As the proffer states, and as confirmed by Dr. Rollick's deposition testimony, the purpose of the 2008-09 experiments was to determine the source of the intense blue color observed during the manufacturing of the PoliProtect products and to find potential solutions. (*Id.* at ¶ 3; Dr. Rollick's deposition at 35:8-38:2, 44:2-10) M&G now requires Dr. Rollick to testify at

⁵Rule 701 was explicitly amended in 2000 to

eliminate the risk that the reliability requirements set forth in Rule 702 will be evaded through the simple expedient of proffering an expert in lay witness clothing. . . . By channeling testimony that is actually expert testimony to Rule 702, the amendment also ensures that a party will not evade the expert witness disclosure requirements set forth in Fed. R. Civ. P. 26 . . . by simply calling an expert witness in the guise of a layperson.

Fed. R. Evid. 702 advisory committee's note.

trial on a wholly different issue – the extent to which cobalt neodecanoate complexes – which has emerged during litigation as important to its noninfringement defense. Dr. Rollick's interpretation of data from the 2008-09 experiments, drawn in view of litigation and requiring scientific or technical expertise, cannot constitute fact testimony or lay witness opinions.

12. Dr. Rollick subsequently submitted declarations to the PTO presenting data from the 2012-13 experiments and opining on the extent to which cobalt neodecanoate complexes. For example, in a declaration to the PTO dated November 15, 2012, he submitted various spectroscopy graphs and opined: "It is my belief that because the intensity stopped increasing after increasing 185 units, all cobalt was tetrahedrally-coordinated, that is, in cobaltate form. . . . It is my opinion that all the cobalt in the tested PoliProtect sample . . . is in a cobaltate form."⁶ (D.I. 406, ex. G at MG00525590, MG00525600) As Dr. Rollick conceded in his deposition, his opinions in this regard were based on spectroscopy studies that he conducted in the 2012-13 experiments but which he did not conduct in the 2008-09 experiments. (See Dr. Rollick deposition at 75:2-76:17) The data from the 2012-13 experiments, as with the 2008-09 experiments, do not include self-evident facts regarding the extent to which cobalt neodecanoate

⁶Dr. Rollick submitted another declaration to the PTO on June 13, 2013, which was produced to Invista on June 18, 2013, after Invista had deposed Dr. Rollick. (D.I. 403, ex. I)

complexes.⁷ (*Id.* at 33:25-34:4) Any opinions to be drawn would require an expert to explain, interpret, and opine on the data using his scientific or technical knowledge.

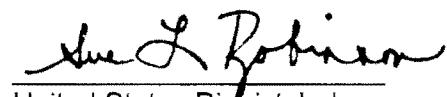
13. M&G suggests that, because Dr. Rollick was hired by M&G's patent prosecution counsel rather than its litigation counsel and because his opinions were submitted in connection with the '345 application, he should be able to present those opinions he submitted to the PTO as fact testimony in this trial. (D.I. 403 at 6) Dr. Rollick's conclusions drawn from the 2012-13 experiments, however, are expert opinions, made as a paid consultant contemporaneously with this litigation. They are not within the purview of a fact witness and, most significantly, Dr. Rollick's testimony (whether fact or expert) regarding the extent to which cobalt neodecanoate complexes was never vetted during discovery and, submitted on the eve of trial, is untimely.

14. To the extent M&G seeks to rely on Dr. Rollick's testing and testimony to support its motion for reconsideration, a motion for reconsideration "may not be used by the losing litigant as a vehicle to supplement or enlarge the record provided to the [c]ourt and upon which the merits of the decision was made unless new factual matters **not previously obtainable** have been discovered since the issue was submitted to the [c]ourt." *Schering Corp. v. Amgen, Inc.*, 25 F. Supp. 2d 293, 295 (D. Del. 1998). M&G admits that Dr. Rollick's testimony is "new evidence" that was not presented to the court during summary judgment briefing. (D.I. 405 at 10) Nevertheless, it asserts that a manifest injustice exception applies to warrant the court's consideration of the new

⁷Indeed, Dr. Rollick admitted during his deposition that his role in prosecuting the patent included "the interpretation of the results." (Dr. Rollick's deposition at 33:25-34:4)

evidence. (*Id.*) (citing *Sabatini v. Its Amore Corp.*, 455 F. App'x 251, 254-55 (3d Cir. 2011)). The new evidence that M&G seeks to introduce was available to it before the summary judgment stage. In light of M&G's own delay and the court's finding that Dr. Rollick's testimony, in relevant part, is not proper for a fact witness, manifest injustice will inure to Invista if this testimony were permitted, not the reverse.

15. **Conclusion.** For the foregoing reasons, the court denies M&G's motion for reconsideration and rejects the proffer.



United States District Judge

IN THE UNITED STATES DISTRICT COURT
FOR THE DISTRICT OF DELAWARE

INVISTA NORTH AMERICA S.À.R.L.)
and AURIGA POLYMERS INC.,)
)
Plaintiffs,)
)
v.) Civ. No. 11-1007-SLR-CJB
)
M&G USA CORPORATION and M&G)
POLYMERS USA, LLC,)
)
Defendants.)

MEMORANDUM ORDER

At Wilmington this 16th day of July, 2013, having reviewed defendants M&G USA Corporation and M&G Polymers USA, LLC's (collectively, "M&G's") request to preclude INVISTA North America S.à.r.l. and Auriga Polymers Inc. (collectively, "Invista") from presenting testimony or evidence relating to M&G's prior product ActiTUF;

IT IS ORDERED that said request is denied, for the reasons that follow:

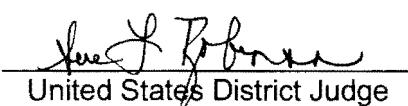
1. As reflected in the joint pretrial order (D.I. 369 at 32) and at the June 26, 2013 pretrial conference, M&G argues that testimony or evidence relating to ActiTUF is not relevant to the issues at trial and will likely confuse a jury. ActiTUF is a plastics product with an iron-based system, rather than the cobalt-based system allegedly developed by Invista. There is no dispute that ActiTUF existed at the time of Invista's claimed invention.

2. Invista asserts that ActiTUF is relevant to at least the state of the art at the time of the invention and secondary considerations. (*Id.* at 19-20) Invista argues that it

would present evidence at trial regarding how the inventors of its claimed inventions looked to improve on the problems with ActiTUF's iron-based system. Invista further contends that the relevant market is a two-person market and that the inventors, in their development process, referred specifically to ActiTUF.

3. The court finds that, although ActiTUF is not an accused product in this litigation, testimony or evidence relating to it is relevant to the state of the art at the time of the invention and secondary considerations. Such evidence would not likely confuse a jury because there is no dispute that ActiTUF uses a different approach and is not covered by the patents at issue for trial. Accordingly, the court denies M&G's request to preclude Invista from presenting testimony or evidence at trial regarding ActiTUF.

IT IS FURTHER ORDERED that only jury selection and preliminary jury instructions will take place on July 17, 2013.



United States District Judge

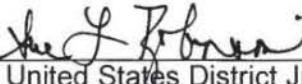
IN THE UNITED STATES DISTRICT COURT
FOR THE DISTRICT OF DELAWARE

INVISTA NORTH AMERICA S.À.R.L.)
and AURIGA POLYMERS INC.,)
)
Plaintiffs,)
)
v.) Civ. No. 11-1007-SLR-CJB
)
M&G USA CORPORATION and M&G)
POLYMERS USA, LLC,)
)
Defendants.)

**JUDGMENT FOLLOWING A JURY VERDICT
PURSUANT TO FED. R. CIV. P. 58(b)**

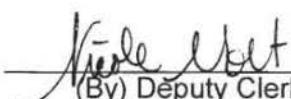
For reasons stated in the jury verdict of July 24, 2013;

IT IS ORDERED AND ADJUDGED that judgment be and is hereby entered in favor of plaintiffs Invista North America S.à.r.l. and Auriga Polymers Inc. and against defendants M&G USA Corporation and M&G Polymers USA, LLC.



United States District Judge

Dated: 7/29/2013



(By) Deputy Clerk

IN THE UNITED STATES DISTRICT COURT

FOR THE DISTRICT OF DELAWARE

INVISTA NORTH AMERICA S.À.R.L.)
and AURIGA POLYMERS INC.)
)
Plaintiffs,)
)
v.) Civ. No. 11-1007-SLR-CJB
)
M&G USA CORPORATION and M&G)
POLYMERS USA, LLC,)
)
Defendants.)

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Richard L. Horwitz, Esquire, David E. Moore, Esquire, and Bindu A. Palapura, Esquire of Potter Anderson & Corroon LLP, Wilmington, Delaware. Counsel for Defendants. Of Counsel: Megan D. Dertzenzo, Esquire, and Arthur Licygiewicz, Esquire of Thompson Hine LLP.

MEMORANDUM OPINION

Dated: March 31, 2014
Wilmington, Delaware



ROBINSON, District Judge

I. INTRODUCTION

Plaintiffs INVISTA North America S.à.r.l. ("Invista") and Auriga Polymers Inc.¹ ("Auriga") (collectively, "plaintiffs") sued M&G USA Corporation and M&G Polymers USA, LLC (collectively, "defendants") for infringement of U.S. Patent Nos. 7,919,159 ("the '159 patent"), 7,943,216 ("the '216 patent"), and 7,879,930 ("the '930 patent") (collectively, "the patents-in-suit"). (D.I. 1; D.I. 7) Defendants asserted counterclaims seeking declaratory judgment of non-infringement and invalidity of the patents-in-suit. (D.I. 42)

In a memorandum opinion and order dated June 25, 2013, the court resolved several summary judgment motions.² (D.I. 382; D.I. 383) The parties proceeded to trial on July 18, 2013 on infringement of claim 4 and on the validity of several asserted claims of the '216 patent. At the close of evidence, the court granted plaintiffs' motion for judgment as a matter of law ("JMOL") regarding infringement of claim 4. On July 24, 2013, the jury returned a verdict that the '216 patent was valid. Currently before the court are several motions: defendants' renewed motions for JMOL on invalidity and non-infringement (D.I. 470; D.I. 473); plaintiffs' motion for an injunction (D.I. 467); defendants' motion for leave to file amended pleadings (D.I. 365); defendants' motion for reargument of the court's July 16, 2013 oral order (D.I. 444); and the parties' motions for attorney fees (D.I. 451; D.I. 452; D.I. 455). The court has jurisdiction over

¹Auriga Polymers was added as a plaintiff by a joint stipulation entered by the court on April 30, 2012. (D.I. 52)

²The court denied (D.I. 421) defendants' motion for reconsideration of the court's grant of summary judgment of indirect infringement for the asserted claims (except claim 4) of the '216 patent (D.I. 404).

these matters pursuant to 28 U.S.C. § 1338.

II. BACKGROUND

A. Technology Overview

Plastic polymers are commonly used for making food and beverage containers and offer several advantages over the use of glass or metal. They are lighter in weight, have less breakage, and can potentially lower costs. (‘216 patent, 1:25-27) Polymers are synthesized by reacting monomers to form a larger polymer chain, and made into bottles by a method called stretch blow molding, wherein the polymer resin is typically dried, melted and extruded into preforms. (7:56-58) The preforms are then heated and blown-molded into bottles of desired shape and size. (7:62-64)

One type of polymer, polyester, has been widely used in the bottling industry for many years. Polyethylene terephthalate (“PET”) is a common example of a polyester. (2:34, 8:16) Polyesters can be prepared by reacting diesters (e.g., dicarboxylic ester) or diacids (e.g., terephthalic acid) with ethylene glycol (“EG”). (3:27-31). Because of polyesters’ inferior gas-barrier properties, these materials limit the shelf life of oxygen-sensitive foods, condiments, and beverages (such as juice, soda, or beer). (1:27-33)

In the prior art, it was known that the use of low-gas permeable polymers, known as partially aromatic polyamides (or “nylons”), with polyesters increases barrier properties. (1:31-38) Partially aromatic polyamides have non-scavenging, or “passive,” barrier properties, meaning they restrict carbon dioxide leakage from, and oxygen intrusion into, a container by obstructing the paths of gas molecules. (1:21) However,

partially aromatic polyamides are not miscible with polyesters like PET, and they also give containers an undesirable yellow and hazy appearance. (1:44-46)

It was commonly known in the art that combining a thin layer of a partially aromatic polyamide, like MXD6,³ with one or more layers of polyester in multilayer bottles increased barrier properties. (1:35-43) This multilayer system, however, produced bottles with undesirable haze. (1:33-35) It was also known in the art that the addition of a transition metal catalyst, such as cobalt salt, improved the gas barrier properties of polyamide multilayer containers and blends with PET by promoting active oxygen scavenging. (2:32-48)

B. The '216 Patent

According to the patentee, no prior art disclosed a monolayer container with a desirable balance of high gas barrier properties and low yellowness and haze, as taught by the '159 and '216 patents. ('216 patent, 2:55-61, 2:65-3:13) The invention is useful as packaging for oxygen-sensitive foods that require a long shelf life. (2:55-67) The '216 patent discloses a three component composition. Claim 1 of the '216 patent recites:

A composition for containers comprising:
a copolyester comprising a metal sulfonate salt;
a partially aromatic polyamide;
and a cobalt salt.

Dependant claim 4 recites “[t]he composition of claim 1, wherein said cobalt salt is present in a range from about 20 to about 500 ppm of said composition.”

The “copolyester comprising a metal sulfonic salt” is termed a “compatibilizer.” A

³MXD6 is the commercial name for poly(m-xylylene adipamide). (1:37-38)

metal sulfonate salt discussed in the '216 patent is 5-sulfoisophthalic acid ("SIPA").

(8:41)

III. STANDARDS OF REVIEW

A. Renewed Motion for Judgment as a Matter of Law

To prevail on a renewed motion for judgment as a matter of law following a jury trial, the moving party "must show that the jury's findings, presumed or express, are not supported by substantial evidence or, if they were, that the legal conclusions implied [by] the jury's verdict cannot in law be supported by those findings." *Pannu v. Iolab Corp.*, 155 F.3d 1344, 1348 (Fed. Cir. 1998) (quoting *Perkin-Elmer Corp. v. Computer Vision Corp.*, 732 F.2d 888, 893 (Fed. Cir. 1984)). "Substantial" evidence is such relevant evidence from the record taken as a whole as might be acceptable by a reasonable mind as adequate to support the finding under review." *Perkin-Elmer Corp.*, 732 F.2d at 893. In assessing the sufficiency of the evidence, the court must give the non-moving party, "as [the] verdict winner, the benefit of all logical inferences that could be drawn from the evidence presented, resolve all conflicts in the evidence in his favor, and in general, view the record in the light most favorable to him." *Williamson v. Consol. Rail Corp.*, 926 F.2d 1344, 1348 (3d Cir. 1991); *Perkin-Elmer Corp.*, 732 F.2d at 893. The court may not determine the credibility of the witnesses nor "substitute its choice for that of the jury between conflicting elements of the evidence." *Perkin-Elmer Corp.*, 732 F.2d at 893. In sum, the court must determine whether the evidence reasonably supports the jury's verdict. See *Dawn Equip. Co. v. Kentucky Farms Inc.*, 140 F.3d 1009, 1014 (Fed. Cir. 1998).

B. Motion for a New Trial

Federal Rule of Civil Procedure 59(a) provides, in pertinent part:

A new trial may be granted to all or any of the parties and on all or part of the issues in an action in which there has been a trial by jury, for any of the reasons for which new trials have heretofore been granted in actions at law in the courts of the United States.

Fed. R. Civ. P. 59(a). The decision to grant or deny a new trial is within the sound discretion of the trial court and, unlike the standard for determining judgment as a matter of law, the court need not view the evidence in the light most favorable to the verdict winner. See *Allied Chem. Corp. v. Daiflon, Inc.*, 449 U.S. 33, 36 (1980); *Olefins Trading, Inc. v. Han Yang Chem. Corp.*, 9 F.3d 282 (3d Cir. 1993); *LifeScan Inc. v. Home Diagnostics, Inc.*, 103 F. Supp. 2d 345, 350 (D. Del. 2000) (citations omitted); see also 9A Wright & Miller, *Federal Practice and Procedure* § 2531 (2d ed. 1994) ("On a motion for new trial the court may consider the credibility of witnesses and the weight of the evidence."). Among the most common reasons for granting a new trial are: (1) the jury's verdict is against the clear weight of the evidence, and a new trial must be granted to prevent a miscarriage of justice; (2) newly-discovered evidence exists that would likely alter the outcome of the trial; (3) improper conduct by an attorney or the court unfairly influenced the verdict; or (4) the jury's verdict was facially inconsistent. See *Zarow-Smith v. N.J. Transit Rail Operations*, 953 F. Supp. 581, 584–85 (D.N.J. 1997) (citations omitted). The court must proceed cautiously, mindful that it should not simply substitute its own judgment of the facts and the credibility of the witnesses for those of the jury. Rather, the court should grant a new trial on the basis

that the verdict was against the weight of the evidence only where a miscarriage of justice would result if the verdict were to stand. See *Williamson*, 926 F.2d at 1352; *EEOC v. Del. Dep't of Health & Soc. Servs.*, 865 F.2d 1408, 1413 (3d Cir. 1989).

C. Motion for Reconsideration or Amendment of the Judgment

A motion for reconsideration is the “functional equivalent” of a motion to alter or amend judgment under Federal Rule of Civil Procedure 59(e). See *Jones v. Pittsburgh Nat'l Corp.*, 899 F.2d 1350, 1352 (3d Cir. 1990) (citing *Fed. Kemper Ins. Co. v. Rauscher*, 807 F.2d 345, 348 (3d Cir. 1986)). The standard for obtaining relief under Rule 59(e) is difficult to meet. The purpose of a motion for reconsideration is to “correct manifest errors of law or fact or to present newly discovered evidence.” *Max's Seafood Cafe ex rel. Lou-Ann, Inc. v. Quinteros*, 176 F.3d 669, 677 (3d Cir. 1999). A court should exercise its discretion to alter or amend its judgment only if the movant demonstrates one of the following: (1) a change in the controlling law; (2) a need to correct a clear error of law or fact or to prevent manifest injustice; or (3) availability of new evidence not available when the judgment was granted. See *id.* A motion for reconsideration is not properly grounded on a request that a court rethink a decision already made and may not be used “as a means to argue new facts or issues that inexcusably were not presented to the court in the matter previously decided.” *Brambles USA, Inc. v. Blocker*, 735 F. Supp. 1239, 1240 (D. Del. 1990); see also *Glendon Energy Co. v. Borough of Glendon*, 836 F. Supp. 1109, 1122 (E.D. Pa. 1993).

IV. DISCUSSION

A. Defendants' Renewed JMOL Motion on Non-Infringement

1. Standard

A patent is infringed when a person “without authority makes, uses or sells any patented invention, within the United States . . . during the term of the patent.” 35 U.S.C. § 271(a). To prove direct infringement, the patentee must establish, by a preponderance of the evidence, that one or more claims of the patent read on the accused device literally or under the doctrine of equivalents. See *Advanced Cardiovascular Sys., Inc. v. Scimed Life Sys., Inc.*, 261 F.3d 1329, 1336 (Fed. Cir. 2001). A two-step analysis is employed in making an infringement determination. See *Markman v. Westview Instruments, Inc.*, 52 F.3d 967, 976 (Fed. Cir. 1995). First, the court must construe the asserted claims to ascertain their meaning and scope. See *id.* Construction of the claims is a question of law subject to de novo review. See *Cybor Corp. v. FAS Techs.*, 138 F.3d 1448, 1454 (Fed. Cir. 1998). The trier of fact must then compare the properly construed claims with the accused infringing product. See *Markman*, 52 F.3d at 976. This second step is a question of fact. See *Bai v. L & L Wings, Inc.*, 160 F.3d 1350, 1353 (Fed. Cir. 1998).

“Direct infringement requires a party to perform each and every step or element of a claimed method or product.” *Exergen Corp. v. Wal-Mart Stores, Inc.*, 575 F.3d 1312, 1320 (Fed. Cir. 2009) (internal quotation marks omitted). “If any claim limitation is absent from the accused device, there is no literal infringement as a matter of law.” *Bayer AG v. Elan Pharm. Research Corp.*, 212 F.3d 1241, 1247 (Fed. Cir. 2000). If an accused product does not infringe an independent claim, it also does not infringe any claim depending thereon. See *Wahpeton Canvas Co. v. Frontier, Inc.*, 870 F.2d 1546,

1553 (Fed. Cir. 1989). However, “[o]ne may infringe an independent claim and not infringe a claim dependent on that claim.” *Monsanto Co. v. Syngenta Seeds, Inc.*, 503 F.3d 1352, 1359 (Fed. Cir. 2007) (quoting *Wahpeton Canvas*, 870 F.2d at 1552) (internal quotations omitted). The patent owner has the burden of proving infringement and must meet its burden by a preponderance of the evidence. See *SmithKline Diagnostics, Inc. v. Helena Lab. Corp.*, 859 F.2d 878, 889 (Fed. Cir. 1988) (citations omitted).

To establish indirect infringement, a patent owner has available two theories: active inducement of infringement and contributory infringement. See 35 U.S.C. § 271(b) & (c). To establish active inducement of infringement, a patent owner must show that an accused infringer “knew or should have known [their] actions would induce actual infringements.” *DSU Med. Corp. v. JMS Co., Ltd.*, 471 F.3d 1293, 1306 (Fed. Cir. 2006). To establish contributory infringement, a patent owner must show that an accused infringer sells “a component of a patented machine … knowing the same to be especially made or especially adapted for use in an infringement of such patent, and not a staple article or commodity of commerce suitable for substantial noninfringing use.” *Golden Blount, Inc. v. Robert H. Peterson Co.*, 365 F.3d 1054, 1061 (Fed. Cir. 2004) (quoting 35 U.S.C. § 271(c)). Liability under either theory, however, depends on the patent owner having first shown direct infringement. *Joy Technologies, Inc. v. Flakt, Inc.*, 6 F.3d 770, 774 (Fed. Cir. 1993).

2. Analysis

A motion for JMOL will be granted when “a party has been fully heard on an

issue and there is no legally sufficient evidentiary basis for a reasonable jury to find for that party on that issue." Fed. R. Civ. P. 50(a). Defendants renew their motion for JMOL on the issue of non-infringement⁴ (D.I. 473), arguing that the court improperly granted plaintiff's motion for JMOL at trial, as it was clear error of law to: (1) exclude the testimony of defendants' witness, Steven Ryba; (2) prohibit defendants from rebutting plaintiffs' expert, Dr. Turner's testimony; and (3) allow Dr. Turner to testify as to the FDA documents. Defendants also assert that plaintiffs did not introduce any evidence for a reasonable juror to find indirect infringement.

With respect to infringement of claim 4, plaintiffs sought to prove whether defendants' accused products satisfied the additional limitation of claim 4, that the cobalt salt be present in a range from about 20 to about 500 ppm of the composition. ('216 patent, 13:39-41) Plaintiffs' expert testified regarding the range of cobalt salt in the accused products. (D.I. 543 at 441:24-445:13, 447:4-449:3, 449:5-450:12) Defendants moved for JMOL of non-infringement, alleging that plaintiffs had not offered evidence (only conclusory statements) on the amount of salt. (D.I. 543 at 515:24-518:20) The court then heard argument and requested statements from the parties on the admissibility of defendants' anticipated defense and evidence. (D.I. 543 at 518:21-540:21) After reviewing the statements, the court excluded certain testimony and

⁴Plaintiffs contend this renewal is procedurally improper as there was no jury verdict. Defendants properly moved for JMOL during the course of the trial. The parties have not provided and the court has not found any clear direction in the case law that defendants are precluded from renewing the motion. *Cf. Stewart v. Walbridge, Aldinger Co.*, 882 F. Supp. 1441, 1443 (D. Del. 1995) (finding "[t]he fact that the jury was unable to reach a unanimous verdict does not in any way affect this Court's duty to rule on the [renewed JMOL]).

evidence. (D.I. 431; D.I. 432; D.I. 544 at 548:7-549:12) Pursuant to the exclusions, defendants' expert testified that he had no opinion as to the amount of cobalt salt in the final accused products. (D.I. 544 at 612:13-16)

At the close of evidence, the court granted plaintiffs' motion for JMOL, finding that defendants indirectly infringed claim 4. The court declines to revisit the evidentiary decisions made during the course of trial as to the evidence allowed or excluded. The court did not arrive at these decisions lightly, indeed, the court entertained both argument and briefing on these issues. The court reached its decision based on the admissible evidence described above. (D.I.545 at 977:8-978:23) Defendants now offer attorney argument to analyze plaintiffs' expert testimony at trial and argue that it does not support the conclusion that the cobalt salt is present in the specified range. However, plaintiffs' expert testified based on defendants' core technical documents, which defendants confirmed were accurate.

Defendants rely on the same arguments described above to move for reconsideration or amendment of the judgment. Defendants request that the court rethink its decisions on the evidentiary issues at trial, precisely the type of request that is not properly the grounds for such a motion. Neither have defendants shown a "manifest injustice." Defendants' renewed motion for JMOL of non-infringement is denied.

B. Defendants' Renewed JMOL Motion on Invalidity

Defendants advance several arguments in support of the renewed motion for JMOL. Defendants assert that "a reasonable jury considering all of the evidence would find by clear and convincing evidence that each of the [a]sserted [c]laims are invalid

under 35 U.S.C. §103 as obvious in view of the cited prior art.” Defendants also argue that each of the limitations was present in the prior art and a person of ordinary skill⁵ would have been motivated to combine the prior art references. Further, according to defendants, plaintiffs did not “rebut [defendants] strong showing of obviousness,” relying on expert testimony that was “conclusory, outside the scope of his expert report, or unsupported by the evidence.” Finally, plaintiffs allegedly did not show any secondary considerations of nonobviousness, including a nexus between the claimed features and any unexpected results or commercial success. (D.I. 471 at 6)

Defendants’ motion focuses on three combinations: (1) European Patent Application No. 0301719 (DTX 268, “the ‘719 reference”) and Japanese Patent No. 2663578 (DTX 314, “the ‘578 patent”); (2) International Patent Application No. WO 98/13266 (DTX 109, “the ‘266 reference”) and the ‘578 patent; and (3) International Application No. WO 91/17925 (DTX 9, the ‘925 reference”) and International Application No. WO 03/080731 (DTX 107, “the ‘731 reference”). The prior art references were before the U.S. Patent and Trademark Office (“PTO”) during prosecution, with the exception of the ‘925 reference. The full translation of the ‘578 patent was only provided to the PTO after the notice of allowance was received.

1. Obviousness

a. Standard

⁵In the case at bar, the parties agreed that a person of ordinary skill in the art at the relevant time is a person who has obtained at least a Bachelors of Science or Masters of Science degree in a chemistry, polymer science, chemical engineering, material science, or a related field and at least three years of experience or training in researching, studying, designing, or manufacturing polyester resins.

“A patent may not be obtained . . . if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art.” 35 U.S.C. § 103(a). Obviousness is a question of law, which depends on underlying factual inquiries.

Under § 103, the scope and content of the prior art are to be determined; differences between the prior art and the claims at issue are to be ascertained; and the level of ordinary skill in the pertinent art resolved. Against this background the obviousness or nonobviousness of the subject matter is determined. Such secondary considerations as commercial success, long felt but unsolved needs, failure of others, etc., might be utilized to give light to the circumstances surrounding the origin of the subject matter sought to be patented.

KSR Int'l Co. v. Teleflex Inc., 550 U.S. 398, 406 (2007) (quoting *Graham v. John Deere Co.*, 383 U.S. 1, 17-18 (1966)).

“[A] patent composed of several elements is not proved obvious merely by demonstrating that each of its elements was, independently, known in the prior art.” *KSR*, 550 U.S. at 418. Likewise, a defendant asserting obviousness in view of a combination of references has the burden to show that a person of ordinary skill in the relevant field had a reason to combine the elements in the manner claimed. *Id.* at 418-19. The Supreme Court has emphasized the need for courts to value “common sense” over “rigid preventative rules” in determining whether a motivation to combine existed. *Id.* at 419-20. “[A]ny need or problem known in the field of endeavor at the time of invention and addressed by the patent can provide a reason for combining the elements in the manner claimed.” *Id.* at 420. In addition to showing that a person of

ordinary skill in the art would have had reason to attempt to make the composition or device, or carry out the claimed process, a defendant must also demonstrate that "such a person would have had a reasonable expectation of success in doing so."

PharmaStem Therapeutics, Inc. v. ViaCell, Inc., 491 F.3d 1342, 1360 (Fed. Cir. 2007).

A combination of prior art elements may have been "obvious to try" where there existed "a design need or market pressure to solve a problem and there [were] a finite number of identified, predictable solutions" to it, and the pursuit of the "known options within [a person of ordinary skill in the art's] technical grasp" leads to the anticipated success. *Id.* at 421. In this circumstance, "the fact that a combination was obvious to try might show that it was obvious under § 103." *Id.*

A fact finder is required to consider secondary considerations, or objective indicia of nonobviousness, before reaching an obviousness determination, as a "check against hindsight bias." See *In re Cyclobenzaprine Hydrochloride Extended-Release Capsule Patent Litig.*, 676 F.3d 1063, 1079 (Fed. Cir. 2012). "Such secondary considerations as commercial success, long felt but unsolved needs, failure of others, etc., might be utilized to give light to the circumstances surrounding the origin of the subject matter sought to be patented." *Graham v. John Deere Co. of Kansas City*, 383 U.S. 1, 17–18 (1966).

"Because patents are presumed to be valid, see 35 U.S.C. § 282, an alleged infringer seeking to invalidate a patent on obviousness grounds must establish its obviousness by facts supported by clear and convincing evidence." *Kao Corp. v. Unilever U.S., Inc.*, 441 F.3d 963, 968 (Fed. Cir. 2006) (citation omitted). In conjunction

with this burden, the Federal Circuit has explained that,

[w]hen no prior art other than that which was considered by the PTO examiner is relied on by the attacker, he has the added burden of overcoming the deference that is due to a qualified government agency presumed to have properly done its job, which includes one or more examiners who are assumed to have some expertise in interpreting the references and to be familiar from their work with the level of skill in the art and whose duty it is to issue only valid patents.

PowerOasis, Inc. v. T-Mobile USA, Inc., 522 F.3d 1299, 1304 (Fed. Cir. 2008) (quoting *Am. Hoist & Derrick Co. v. Sowa & Sons*, 725 F.2d 1350, 1359 (Fed. Cir. 1984)).

b. The combination of the '719 reference and the '578 patent

i. Evidence regarding the prior art combination

At trial, defendants' expert, Dr. Moore, testified that the combination of the '719 reference and the '578 patent disclosed each limitation of the asserted claims.⁶ (D.I. 544 at 630:10-643:25) Specifically, the '719 reference describes a composition for containers (*id.* at 635:10-636:3), made using a partially aromatic polyamide (MXD6) (*id.* at 636:8-637:1) and a cobalt salt (*id.* at 637:2-16). The '578 patent also describes a composition for containers (*id.* at 639:13-640:2) and provides a copolyester comprising a metal sulfonate salt element (*id.* at 640:3-18) and a partially aromatic polyamide (MXD6) element (*id.* at 640:19-641:2).

⁶Plaintiffs assert that Dr. Moore simply did a "word search" to find the information relevant to the elements for the combinations while testifying, however, Dr. Moore testified that although he "was basically doing a word search up here at the time . . . when [he] did this for [his] report, it was a very careful analysis." (D.I. 544 at 744:20-745:11)

As to motivation to combine,⁷ Dr. Moore testified that:

[T]he '719 reference is an active oxygen barrier. The oxygen scavenging process, there's significant teachings in this paper about how that, how that works. The oxygen scavenging effectiveness is found to depend on different types of fillers and additives. The only difference here is that it's not specifically using a, a copolyester including metal sulfonate salt. It's just -- in fact, this is just an active barrier composition. It would be better to have a more particularly, if you're interested in greatly reducing the haze in your -- in your blend of these two polymers, you would want to bring in a compatibilizer.

And so the prior art reference of Yamamoto in the '578 deals with sulfonated PET for monolayer passive barriers. It doesn't have the cobalt salt as you can see there, so if you want to go into now a compatible active barrier, you would combine those two.

(*Id.* at 633:20-634:12) Dr. Moore also testified that "if someone wanted to create a homogeneous active oxygen barrier that has greatly reduced haze, they would bring in the sulfonated polyester from the '578 [patent] into the . . . active oxygen barrier technology taught by the '719."⁸ (*Id.* at 644:5-9)

Plaintiffs' expert, Dr. Turner, testified that the '719 reference discloses the application of an oxygen scavenging system," and describes MXD6 and a cobalt salt. However, the '719 reference does not discuss or teach a compatibilizer, and does not

⁷Dr. Moore testified that he was unsure if there had to be a motivation to combine evident to a person of ordinary skill in order for a patent to be obvious. (D.I. 544 at 733:4-18) Plaintiffs' argument that Dr. Moore failed to perform a proper obviousness analysis is overreaching, as Dr. Moore explained his opinion on the motivation to combine to the jury.

⁸To bolster this testimony, defendants cite to the '578 patent, which states "[a]s can be clearly understood from Table 3, when polyester copolymerized with 5-sodium sulfolsophthalic acid is used as the component (C), the transparency is improved and the haze is notably reduced. ('578 patent at MG3928) However, defendants do not point to testimony in the record showing that this statement was presented to the jury.

further suggest the use thereof, as “[i]t proposes a solution without the compatibilizer” (D.I. 545 at 885:8-886:11) The ‘719 reference does not teach a copolyester containing a metal sulfonate salt or how to achieve a reduction in haze or yellowness. (*Id.* at 886:16-887:5) The ‘719 reference contains barrier data, which shows significant barrier improvement, however, Dr. Turner opined that the ‘719 reference did not “teach[] that this would give . . . the whole set of properties needed to be successful in the . . . packaging industry for oxygen sensitive foods.” (*Id.* at 887:25-888:2) The ‘578 patent does not disclose cobalt salt nor does it suggest the use thereof, as it does not touch on color issues or yellowness. (*Id.* at 888:19-889:17)

Dr. Turner testified that there would be no motivation to combine, because

the ‘719 [reference] doesn’t teach compatibilizers or copolyesters with metal sulfonate salt. It doesn’t teach reduction in haze or yellowness. And neither does the ‘578 patent teach that. So they really don’t teach solutions to the major problems that have to be solved to meet this challenge to make a new container for beer.

(*Id.* at 889:20-890:6) Therefore, Dr. Turner concluded that the combination does not render the claims obvious. (*Id.* at 890:7-10)

ii. Evidence regarding secondary considerations⁹

Plaintiffs also offered evidence of secondary considerations of nonobviousness, including unexpected results, long-felt need, failure of others, and commercial success. Dr. Schiraldi, one of the four named inventors on the ‘216 patent, testified that bottles with multilayered walls came into the marketplace in the late 1990s, but had a “dull,

⁹The evidence of secondary considerations applies to every combination and will not be repeated below.

hazy look[]." (D.I. 542 at 269:3-20, 271:5-272:5) Using his manufacturing experience, Dr. Schiraldi experimented¹⁰ using a combination of PET and SIPE,¹¹ focusing on improving the barrier properties. (*Id.* at 267:8-19, 282:19-283:3) He found that while nylon and polyester are not miscible, mixing an MDX6 nylon with PET resulted in an opaque material that was yellowish. (*Id.* at 272:8-273:8)

After reviewing the research of a Spanish professor, who described mixing two dissimilar polymers (not the ones used by Dr. Schiraldi) using a compatibilizer, which resulted in a material with good mechanical properties (*id.* at 277:15-22, 277:19-278:4), Dr. Schiraldi added a third material to the PET/MXD6 combination, to promote mixing. After further research, a mixture of PET/SIPE with MXD6 and PET made the resulting material "nice and crystal clear," but still yellow in color. (*Id.* at 281:6- 282:12, 284:10-14, 290:11-291:8; DTX 499 at INVISTA 871607)

Dr. Liu, another inventor on the '216 patent who worked with Dr. Schiraldi, realized the addition of cobalt resulted in a nearly sixty times increase in oxygen permeation. (D.I. 542 at 309:21-310:5, 354:16-355:4, 319:8-320:4; PTX 652) The scientists needed to resolve the clearness issue as the containers were still yellow. (D.I. 542 at 320:20-321:13; PTX 652) Dr. Liu incorporated Dr. Schiraldi's work and created copolymers with a formulation including PET, MXD6 and cobalt salt. (D.I. 542 at 326:17-329:5; PTX-577 at 9) Unexpectedly, the formulation resulted in reduced haze and reduced yellowness. (D.I. 542 at 329:18-331:2, 332:1-339:10, 342:6-15; PTX 313;

¹⁰Dr. Schiraldi also described two university projects funded from 1992 to 2002, which did not yield commercially viable products. (*Id.* at 268:14-269:2, 274:13-24)

¹¹Used interchangeably to denote SIPA.

PTX 486A) At trial, Dr. Liu explained the synergistic effect of the cobalt and the SIPA, resulting in the noticeably reduced haze and yellowness. (D.I. 542 at 343:1-14, 346:2-351:1; PTX 749) The research resulted in the '216 patent and a commercial product, PolyShield® blended with MXD6 nylon. (D.I. 542 at 351:2-353:22; D.I. 545 at 924:14-23)

With respect to the '216 patent, Dr. Moore testified¹² that he disagreed with the synergistic effect and asserted that there were "many problems with the way that [the inventors] actually brought samples in to compare and too many unfixed variables." Specifically, run 8 (an experiment using a particular combination of materials) contained sodium acetate and a low molecular weight MXD6, which both contributed to the reduction in yellowness. (D.I. 544 at 685:18-688:9) Dr. Moore tried to replicate the experiments in the patent regarding the b* (a measure of yellowness, the larger the b* the more yellow), to determine the effect of sodium acetate. A bluing effect occurred as the amount of sodium acetate increased. Dr. Moore further testified that to set up the experiment, he had to go back to the inventor's laboratory notebooks and retrieve additional information not available in the patent. (*Id.* at 688:10- 691:1) Dr. Moore concluded that sodium acetate was not a controlled variable and, as a result, the synergistic effect was not proven. Dr. Moore also identified additional uncontrolled variables including the use of low molecular weight polyamide and low molecular weight

¹²Dr. Moore's testimony conflated the "unexpected results" of the synergistic effect, an indicia of nonobviousness, and "undue experimentation" as it applies to enablement, which is based on the invention as claimed. The synergistic effect was not claimed. As the review of the evidence focuses on whether the jury's verdict was supported by substantial evidence, the court recites the testimony as it was presented to the jury.

nylon, the use of different starting materials, changes in reaction conditions, the use of other additives, and the source of cobalt. (*Id.* at 691:17-695:25)

On cross-examination, Dr. Moore agreed that "if you change more than one variable or don't control for the others. That is, you don't control for all the variables except the one that you are testing, then you have a flawed test." He also agreed that because sodium acetate is a buffer, changing the amount of sodium acetate, would change how it buffered other components. (*Id.* at 763:20-765:9)

Dr. Turner testified that he was also engaged in research related to solving the yellowness and haziness issue in a PET bottle.¹³ He "believes that the data in the patent show a clear synergy of the ingredients, of the color." Dr. Turner testified that Dr. Moore's testing was not controlled as "chang[ing] the level of [sodium acetate] in the . . . recipe, . . . change[s] the composition of those polymers, and so those polyesters from a very low sodium acetate level to a very high sodium acetate level will not be the exact same polymers." (D.I. 545 at 836:19-837:6) He further opined that Dr. Moore was changing the amount of SIPA, which would "lead to some variation in the final structure of the products that are formed." (*Id.* at 920:2-9) He concluded that the claimed invention yielded a strong synergistic effect in reduction of yellowness, which was both surprising and unexpected. (*Id.* at 906:24-907:16) Dr. Turner explained that table 3 of the '216 patent showed the b* of several different material compositions, illustrating the synergistic effect. (*Id.* at 910:9-914:12) He testified that his conclusion was not changed by the addition of sodium acetate, used as a buffer, in some of the

¹³Dr. Moore agreed the industry was aiming to "find a high barrier, active passive barrier, that also wasn't hazy and was clear, not yellow." (D.I. 544 at 735:13-21)

runs. (*Id.* at 915:15-916:23) He also disagreed that run 8 used a low molecular weight MXD6, although this could be determined by consulting the inventors' notebooks. However, the molecular weight of MXD6 used would not change his opinion on the existence of a synergistic effect. (*Id.* at 916:20-918:1) Dr. Turner also testified that the data in table 7 supports the synergistic effect. (*Id.* at 918:2-10)

As to commercial success, Dr. Embs, director of new business development for Auriga Polymers,¹⁴ testified that PolyShield customers were most interested in "glass light clarity with an excellent oxygen barrier and a good carbonation retention in a PET container that protects the beer throughout the entire shelf life." Further, PolyShield has advantages over other options in the market which are more expensive to produce. (*Id.* at 816:11-817:7) Mr. Francois, head of Invista's specialty materials business, testified that the sales of PolyShield "through the first quarter of 2013 [were] . . . above \$200 million." (D.I. 542 at 242:21-23) After receiving food contact clearance, the first commercial quantity of PolyShield was sold in Europe in January 2005 and in the United States in 2009. (D.I. 545 at 812:24-813:6) Dr. Embs testified that the sales of PolyShield in the US were sample quantities. (*Id.* at 822:2-10) "Polyshield has been most successful" in Eastern Europe, particularly Russia and Romania, due in part to the container size, installation of new filling lines, and in small part to Russia's negative view of glass. (*Id.* at 820:15-821:21) Dr. Embs did not know how many customers add nylon to the purchased PolyShield. (*Id.* at 827:3-15) However, he testified that the global sales of PolyShield from January 2005 to end of 2010 were intended for blending

¹⁴Invista sold off its North American business, which became Auriga. (D.I. 382 at 2; D.I. 545 at 813:16-21)

with MXD6. (*Id.* at 818:17-20) Mr. Francois testified that PolyShield is one of the most successful products across its six specialty materials businesses. (D.I. 542 at 242:24-243:2) PET bottles have been sold in Europe. (D.I. 545 at 813:4-6) The bottles are “qualified at the brewers,” and plaintiffs are “confident” that a beer will be available in a PET container in the next year. (*Id.* at 823:5-825:19)

Defendants’ ActiTUF product was sold as an active barrier resin before the introduction of PolyShield. (*Id.* at 801:7-24) However, ActiTUF had problems with clarity and appearance. (*Id.* at 802:15-806:2) Mr. Fenoglio, defendants’ global director of manufacturing for its PET business, testified¹⁵ that ActiTUF had poor appearance to certain customers and was in need of improvement. (*Id.* at 805:1-806:2) Further, to compete with Invista’s PolyShield, which provided a better appearance, defendants needed to use a product with lithium SIPA. (*Id.* at 807:19-808:21) Mr. Fournier, defendants’ global director of sales and marketing, testified that to combat the complaints regarding ActiTUF, including difficulty in processing the resin and clarity of the product, defendants developed the PoliProtect products (“PoliPorotect”). (D.I. 544 at 569:4-16; D.I. 545 at 808:8-22) Mr. Fournier testified that sales of PoliProtect in the United States were over \$23 million, with an increasing trend since 2009. (*Id.* at 577:1-18)

ii. Analysis

The jury was asked to consider whether defendants presented clear and convincing evidence of invalidity. Both parties presented to the jury the “problem to be

¹⁵In part using Mr. Bolcheni’s (corporate director responsible for the strategic development of barrier market) notes. (D.I. 545 at 803:14-804:17)

solved" as reducing haze and yellowness in the final container. Therefore, a person of ordinary skill would be seeking to improve these two properties of a container material. *KSR*, 550 U.S. at 420. Defendants did not present evidence that the combination was "obvious to try," i.e., that there existed only a finite number of solutions. *Id.* at 421.

As to motivation to combine, the parties' experts gave competing testimony. The jury's job was to decide which testimony was more credible and they were also instructed to take into account secondary considerations. The jury found that the claims of the '216 patent were not obvious in view of the combination presented. Viewing the record in the light most favorable to plaintiffs, the court concludes that the jury credited the testimony of plaintiffs' expert regarding motivation to combine above that of defendants' expert. While defendants seek to minimize any impact of plaintiffs' testimony on secondary considerations, the court concludes that plaintiffs presented evidence of secondary considerations, including unexpected results, long felt need and commercial success. Plaintiffs' PolyShield product is characterized as providing better clarity and less yellowness. These properties are sought by the container industry. Plaintiffs have shown a nexus between the unexpected results and commercial success evidence and the merits of the invention. The jury's verdict is supported by substantial evidence.¹⁶

c. The combination of the '266 reference and the '578 patent

i. Evidence

¹⁶For each combination, the parties focused their arguments on independent claim 1. The analysis as to motivation to combine and secondary considerations applies to both independent claim 1 and the asserted dependent claims.

Dr. Moore testified that the combination of the '266 reference and the '578 patent discloses each limitation of the asserted claims. (*D.I. 544* at 642:5-651:11) Specifically, Dr. Moore testified that the '266 reference discussed "packaging for oxygen sensitive products, such as beer . . ." (*Id.* at 648:1-13) A partially aromatic polyamide (MXD6) and the cobalt salt elements were also described in the patent. (*Id.* at 648:14-25, 649:1-22) As discussed above, Dr. Moore testified that the '578 patent also covered a composition for containers (*id.* at 639:13-640:2) and provided the copolyester comprising a metal sulfonate salt element (*id.* at 640:3-18) and the partially aromatic polyamide (MXD6) element (*id.* at 640:19-641:2).

In discussing combining the '266 reference with a different patent in order to provide the copolyester,¹⁷ Dr. Moore observed that the '266 reference described

an active oxygen barrier system that was actually working very well. . .

There is a tremendous amount of fundamental information inside of this, this particular reference, too, that talks a lot about blend components and how they must be compatible for improved transparency. It teaches the fundamental science that we polymer scientists use to understand why two different polymers don't mix together, and if you want them to mix together, what do you need to do?

So it almost was a roadmap saying pointing over to prior art references like '731, to go get those compatibilizers to help, to help bring in MXD6 to be compatible with PET, for example.

(*Id.* at 647:2-17) Dr. Moore further testified:

¹⁷Defendants argue that this discussion also applies to the combination at bar, as the '578 patent also provides the copolyester and Dr. Moore states below "for reasons that I mentioned earlier." While plaintiffs disagree that this section applies to the combination at bar, Dr. Moore did state "prior art references like '731," which arguably could include the '578 patent.

Well, because for reasons that I mentioned earlier. If you were working on a passive barrier and you wanted an active barrier, you would bring in the cobalt, or if you wanted to have, if you wanted to have, as taught by Schmidt, a very compatible blend component, you would need to bring in a, a sulfonated polyester, for example, that would give a homogeneous micro dispersion to greatly reduce the haze of that system.

(*Id.* at 653:2-9)

Dr. Turner discussed the '266 reference, pointing out that the patent addressed making a plastic beer container, which could be hot filled, withstand some pressure and meet gas permeability requirements for the shelf life of the product. The patent did not discuss haze or yellowness. (D.I. 545 at 855:16-856:5, 856:11-18, 857:10-12) He described the patent as directed towards "a total polyester system" using "an aromatic ester scanning polymer, not a polyamide." Further, the patent did not use a compatibilizer. (*Id.* at 857:25- 859:3) Dr. Turner described the patent as identifying a list of other high barrier polymers, including MXD6, that could be used to make a multilayer bottle. He opined that the patent "points you towards a possible monolayer solution, that's all polyester solution. It certainly doesn't suggest that MXD6 . . . could be put into a monolayer to solve this or to meet this great need that's out there." (*Id.* at 859:9-860:22)

Dr. Turner testified that the '266 reference did not evidence a motivation to combine with a reference teaching "a copolyester comprising a metal sulfonate or containing a metal sulfonate salt." (*Id.* at 861:25-862:2) The '578 patent does not describe or present a motivation to add cobalt salt, nor does it discuss yellowness reduction. Dr. Turner concluded that the combination does not "teach someone skilled

in the art to put the ingredients together that are in the '216 patent that leads to the invention and the discovery that led to solving the huge challenge of making a suitable composition for packaging beer and fruit juice." (*Id.* at 903:21-904:5)

ii. Analysis

Defendants argue that where the technologies from the two prior art references are so interrelated, active barrier solutions and passive barrier solutions, there must be a motivation to combine. *Belden Techs. Inc. v. Superior Essex Commnc's LP*, 802 F. Supp. 2d 555, 572 (D. Del. 2011). The parties' experts again discussed the prior art and testified in opposing fashion, with defendants' expert concluding that there was a motivation to combine and plaintiffs' expert concluding that there was not. The jury is the finder of fact and is tasked with weighing the evidence and credibility. The jury found that the asserted claims of the '216 patent were not obvious in view of this combination, a finding that is supported by substantial evidence, including Dr. Turner's expert testimony and the evidence of secondary considerations.

d. The combination of the '925 and the '731 references

i. Evidence

Dr. Moore testified that the combination of the '925 reference and the '731 reference disclosed each limitation of the asserted claims. (D.I. 544 at 626:10-628:6) Specifically, the '925 reference describes a composition for containers and a partially aromatic polyamide, as well as a cobalt salt. (*Id.* at 624:12-22) Table 1 of the '925 reference lists container compositions containing MDX6. (*Id.* at 626:10-14) The '731 reference also describes a composition for containers, with a copolyester, including a

metal sulfonate salt. It also describes a partially aromatic polyamide, however, this is a passive barrier and the '731 reference does not disclose using a cobalt catalyst. (*Id.* at 621:5-9, 628:8-18)

Dr. Moore testified that, although the '925 reference was missing a "metal sulfonate salt . . . [a person of ordinary skill] would understand that compatibilization is a good thing and it's best to have, as taught in this patent, a container that consists of one layer that's homogeneous." (D.I. 544 at 619:6-18) Dr. Moore testified that a person of ordinary skill wanting "to make an active barrier that was homogeneous, . . . would look at the current literature at the time and find compatibilizers that were effective and . . . may bring over a copolyester, including a metal sulfonate salt." (*Id.* at 621:16-22) Dr. Moore summarized:

So that's just what a person of ordinary skill in the art would be thinking, I guess, at having these two prior art references and what would cause one person to say, let's substitute in sulfonated PET because it's compatible with the MXD6 and greatly reduces the haze.

It also has teachings from another preferred compatibilizer Surlyn, so they'd be looking at the '925 reference and say, well, they were talking about Surlyn, so I can bring those -- it's interchangeable. They're functional equivalents. '731 reference deals with a yellow color from processing can be masked with a blue dye. Cobalt is blue, brings that blue in. That's how the combinations are brought in my motivation.

(*Id.* at 623:8-21)

Dr. Turner testified that the '925 reference taught a complicated system to form a uniform polyamide product using an activated polyamide reacting with a nucleophilic reagent. (D.I. 545 at 891:2-18) "The active barrier is not described in the simple forms of just MXD6 and, and the cobalt salt." (*Id.* at 891:19-25) The '925 reference also did

not teach reducing yellowness or haze, or a copolyester containing a metal sulfonate salt. (*Id.* at 892:13-24) Further, Dr. Turner testified that the '925 reference suggests using "a compatibilizer like Surlyn type, a polyethylene methacrylic acid, . . . not a metal sulfonate salt copolyester." (*Id.* at 893:12-17) Surlyn would not work for a polyester and partially aromatic polyamide blend.¹⁸ (*Id.* at 893:23-894:2) On cross-examination, Dr. Moore agreed that Surlyn was not a copolyester containing a metal sulfonate salt. (D.I. 544 at 738:8-22) Dr. Turner described the '731 reference as listing "an infinite number" of individual compatibilizers and did not disclose cobalt salt. (D.I. 545 at 878:11-879:3) While the '731 reference discloses some haze data, it does not discuss yellowness date. (*Id.* at 880:18-21)

Dr. Turner opined that the '731 reference would not have motivated a person of ordinary skill to select and use a particular polyester ionomer, listed in a huge laundry list of possible compatibilizers. (*Id.* at 880:6-14) Further, a person of ordinary skill would have no motivation to combine the two references as

the '925 has no MXD6 and cobalt salt. There's no teaching to reduce the yellowness, no copolyester with a metal sulfonate salt, and no motivation to use that.
And '731 has this long laundry list, infinite number of compatibilizers. Just, you know, that's -- we do not know which ones of those to choose. There's no cobalt salt. So there would be no expectation that you have success in doing this. There's no yellowness taught. There's no reduction in yellowness.

(*Id.* at 904:15-905:11) "[T]he inventors would not look to these two patents and see the

¹⁸Dr. Turner also pointed out that Dr. Moore's paper (DTX 433) disclosed using an aqueous polyester, not a sulfonated PET proven to be compatible with polyamides. (D.I. 545 at 894:23-895:15)

necessary things that would lead to solving this huge challenge in the bottle area." (*Id.* at 905:4-11) On cross-examination, Dr. Turner did agree that the '731 reference disclosed several preferred compatibilizers, including a copolyester containing metal sulfonate salt and Surlyn polymer. (*Id.* at 946:19-948:16) Dr. Turner further stated that the option of using "one of those preferred compatibilizers with the copolyester containing metal sulfonate salt that's disclosed expressly" couldn't be ruled out. (*Id.* at 950:23-951:12)

ii. Analysis

Defendants argue that Dr. Turner's admission on cross-examination that the option of using the preferred compatibilizer (a copolyester containing metal sulfonate salt) in the '731 reference with a copolyester constitutes clear and convincing evidence of obviousness. Dr. Moore characterized the '731 reference as describing a passive barrier and concluded that a person of ordinary skill would look at the '925 reference, which uses a Surlyn type compatibilizer, and substitute in the copolyester containing metal sulfonate salt from the '731 reference as they are "interchangeable." However, he agreed that Surlyn was not a copolyester containing a metal sulfonate salt, and Dr. Turner explained that Surlyn would not work for a polyester and partially aromatic polyamide blend. Dr. Turner described the references and their teachings, concluding that there would be no motivation to combine. The jury had the opportunity to hear from both experts. Some of Dr. Moore's opinions regarding the motivation to combine were conclusory and the jury found that the asserted claims were not rendered obvious by the combination. While defendants may disagree with the jury's decision, the record

at bar does provide substantial evidence to support such a verdict.

2. Written description and enablement

a. Standard

The statutory basis for the enablement and written description requirements, § 112 ¶1, provides in relevant part:

The specification shall contain a written description of the invention, and of the manner and process of making and using it, in such full, clear, concise, and exact terms as to enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to make and use the same . . .

"The enablement requirement is met where one skilled in the art, having read the specification, could practice the invention without 'undue experimentation.'" *Streck, Inc. v. Research & Diagnostic Systems, Inc.*, 665 F.3d 1269, 1288 (Fed. Cir. 2012) (citation omitted). "While every aspect of a generic claim certainly need not have been carried out by the inventor, or exemplified in the specification, reasonable detail must be provided in order to enable members of the public to understand and carry out the invention." *Genentech, Inc. v. Novo Nordisk A/S*, 108 F.3d 1361, 1366 (Fed. Cir. 1997). The specification need not teach what is well known in the art. *Id.* (citing *Hybritech v. Monoclonal Antibodies, Inc.*, 802 F.2d 1367, 1384 (Fed. Cir. 1986)). A reasonable amount of experimentation may be required, so long as such experimentation is not "undue." *ALZA Corp. v. Andrx Pharmaceuticals, Inc.*, 603 F.3d 935, 940 (Fed. Cir. 2010).

"Whether undue experimentation is needed is not a single, simple factual determination, but rather is a conclusion reached by weighing many factual

considerations.” *Martek Biosciences Corp. v. Nutrinova, Inc.*, 579 F.3d 1363, 1378 (Fed. Cir. 2009) (citing *In re Wands*, 858 F.2d 731, 737 (Fed. Cir. 1988)). The Federal Circuit has provided several factors that may be utilized in determining whether a disclosure would require undue experimentation: (1) the quantity of experimentation necessary; (2) the amount of direction or guidance disclosed in the patent; (3) the presence or absence of working examples in the patent; (4) the nature of the invention; (5) the state of the prior art; (6) the relative skill of those in the art; (7) the predictability of the art; and (8) the breadth of the claims. *In re Wands*, 858 F.2d at 737. These factors are sometimes referred to as the “Wands factors.” The fact finder need not consider every one of the Wands factors in its analysis, rather, a fact finder is only required to consider those factors relevant to the facts of the case. See *Streck, Inc.*, 655 F.3d at 1288 (citing *Amgen, Inc. v. Chugai Pharm. Co., Ltd.*, 927 F.2d 1200, 1213 (Fed. Cir. 1991)).

The enablement requirement is a question of law based on underlying factual inquiries. See *Green Edge Enterprises, LLC v. Rubber Mulch Etc., LLC*, 620 F.3d 1287, 1298-99 (Fed. Cir. 2010) (citation omitted); *Wands*, 858 F.2d at 737. Enablement is determined as of the filing date of the patent application. *In re '318 Patent Infringement Litigation*, 583 F.3d 1317, 1323 (Fed. Cir. 2009) (citation omitted). The burden is on one challenging validity to show, by clear and convincing evidence, that the specification is not enabling. See *Streck, Inc.*, 665 F.3d at 1288 (citation omitted).

A patent must also contain a written description of the invention. 35 U.S.C. §

112, ¶ 1. The written description requirement is separate and distinct from the enablement requirement. *See Ariad Pharmaceuticals, Inc. v. Eli Lilly and Co.*, 598 F.3d 1336, 1351 (Fed. Cir. 2011). It ensures that “the patentee had possession of the claimed invention at the time of the application, i.e., that the patentee invented what is claimed.” *LizardTech, Inc. v. Earth Resource Mapping, Inc.*, 424 F.3d 1336, 1344-45 (Fed. Cir. 2005). The Federal Circuit has stated that the relevant inquiry – “possession as shown in the disclosure” – is an “objective inquiry into the four corners of the specification from the perspective of a person of ordinary skill in the art. Based on that inquiry, the specification must describe an invention understandable to that skilled artisan and show that the inventor actually invented the invention claimed.” *Ariad*, 598 F.3d at 1351.

This inquiry is a question of fact; “the level of detail required to satisfy the written description requirement varies depending on the nature and scope of the claims and on the complexity and predictability of the relevant technology.” *Id.* (citation omitted). In this regard, defendants must provide clear and convincing evidence that persons skilled in the art would not recognize in the disclosure a description of the claimed invention. *See PowerOasis, Inc. v. T-Mobile USA, Inc.*, 522 F.3d 1299, 1306-17 (Fed. Cir. 2008) (citation omitted).

b. Evidence

Dr. Moore opined on the lack of written description and enablement.¹⁹ After explaining his difficulty in duplicating the synergistic effect testing described in table 3,

¹⁹This testimony is set out in more detail above in part IV.B.b.ii, evidence regarding secondary considerations.

Dr. Moore concluded that "it certainly gave [him] a very strong opinion that [the '216] patent is not enabled." (D.I. 544 at 686:6-695:25) Dr. Moore clarified that his opinion on lack of enablement was not based on the lack of disclosure of sodium acetate. (*Id.* at 715:8-10) Dr. Moore also concluded that "[t]here was not enough detail in the written description to allow a person of ordinary skill in the art the opportunity to reproduce and practice that art." (*Id.* at 683:22-684:1)

Dr. Turner disagreed with Dr. Moore's opinion regarding the data in table 3 and the experimentation regarding the synergistic effect.²⁰ As to the lack of written description and enablement, he testified that the patent was enabled and a person of ordinary skill would be able to "make and use a composition for containers containing a partially aromatic polyamide, a cobalt salt, and a copolyester containing a metal sulfonate salt," in a reasonable time without undue experimentation. (D.I. 545 at 928:7-929:16) "[A]ll the elements that are necessary. . . to get to this . . . composition are defined in the specification." (*Id.* at 929:17-25) In reaching his opinion, Dr. Turner considered what was involved in making the claimed compositions and the fact that polymer chemistry is not unpredictable and the reactions are reproducible. Further, "[t]he specifications that are written describe the catalyst systems, describe ratios of sulfonated monomer to include, and give the characteristics of the polymer, or the polymer -- the polymers are made. They're solid stated to high molecular weight, so model polymers." (*Id.* at 935:9-937:19)

Dr. Turner also testified that there was sufficient written description as the patent

²⁰Set out in more detail above in part IV.B.b.ii, evidence regarding secondary considerations.

“describes a copolyester containing a metal sulfonate salt. It describes MXD6 as being added to that, partially aromatic polyamide, and it describes the cobalt salt that’s added to the, to the, to this composition.” Dr. Turner considered Dr. Moore’s testimony regarding uncontrolled variables, however, this did not alter his opinion regarding enablement and written description. (*Id.* at 930:1-11, 937:23-938:17) Dr. Turner did not try to make the composition in his lab, but avers his students could do so. (*Id.* at 968:15-969:5)

c. Analysis

Dr. Moore’s opinion that the patent was not enabled and lacked written description conflicts with his opinion regarding obviousness, that “[t]hese sulfonated polyesters were used . . . all over the place,” his graduate students could have figured out the invention of the ‘216 patent, and “[i]t could be a number of other companies . . . shied away from it because it was obvious.” (D.I. 544 at 762:14-24; 737:7-9) Defendants’ enablement arguments focused on Dr. Moore’s difficulty in duplicating the synergistic effect data.²¹ Dr. Turner explained why, in his opinion, the asserted claims were enabled, i.e., the claimed compositions could be made. The jury concluded that the asserted claims were not invalid for lack of written description or enablement. This verdict is supported by substantial evidence. For these reasons, defendants’ renewed motion for JMOL is denied.

²¹At trial, outside the presence of the jury, the court questioned whether the difficulty in duplicating the synergistic effect data was actually an enablement defense as opposed to an obviousness defense, as no synergistic effect was claimed. (D.I. 544 at 707:2-16; see also D.I. 382 at 39-42 (pointing out that the synergistic effect was not claimed and enablement focuses on the invention as claimed))

In the alternative, defendants requested a new trial should the court deny the motions for JMOL on non-infringement and invalidity. Defendants' request is premised on the same arguments as its renewed motion for JMOL. For the same reasons discussed above, the jury's verdict is not against the clear weight of the evidence, therefore, the court denies defendants' request for a new trial.

V. PLAINTIFFS' MOTION FOR A PERMANENT INJUNCTION

Plaintiffs move for a permanent injunction (D.I. 467) requesting that the court "enjoin [defendants] from manufacturing, using, offering for sale, selling and/or importing . . . PoliProtect APB and PoliProtect JB products until the expiration of" the '216 patent. (*Id.* at 1) Defendants disagree. Although plaintiffs' complaints listed permanent injunctive relief among the sought remedies, plaintiffs have not previously requested an injunction and waited "nearly two years since first accusing [defendants] of infringement" to present the request. (D.I. 481 at 2-3, 13)

A. Standard of Review

In *eBay Inc. v. MercExchange, L.L.C.*, 547 U.S. 388 (2006) (vacating and remanding *MercExchange, L.L.C. v. eBay Inc.*, 401 F.3d 1323, 1339 (Fed. Cir. 2005)) (hereinafter "eBay"), the Supreme Court overruled the Federal Circuit's longstanding "general rule that courts will issue permanent injunctions against patent infringement absent exceptional circumstances." Permanent injunctions in patent cases must be based on a case-by-case assessment of the traditional equitable factors governing injunctions. *Id.* at 1839. That is, to be awarded a permanent injunction, a plaintiff must demonstrate: "(1) that it has suffered an irreparable injury; (2) that remedies available at

law, such as monetary damages, are inadequate to compensate for that injury; (3) that, considering the balance of hardships between the plaintiff and defendant, a remedy in equity is warranted; and (4) that the public interest would not be disserved by a permanent injunction.” *Id.* “[T]he decision whether to grant or deny injunctive relief rests within the equitable discretion of the district courts, and that discretion must be exercised consistent with traditional principles of equity, in patent disputes no less than in other cases governed by such standards.” *Id.* at 1841.

The eBay Court specifically cautioned against the application of categorical rules, classifications and assumptions in these analyses. *Id.* at 1840. Nevertheless, courts, presumably struggling to balance the absence of a presumption of irreparable harm with a patentee’s right to exclude, have frequently focused upon the nature of the competition between plaintiff and defendant in the relevant market in the context of evaluating irreparable harm and the adequacy of money damages. See *TruePosition Inc. v. Andrew Corp.*, 568 F. Supp. 2d 500, 531 (D. Del. 2008).

Courts awarding permanent injunctions typically do so under circumstances in which the plaintiff practices its invention and is a direct market competitor.²² Plaintiffs

²²See, e.g., *Muniauction, Inc. v. Thomson Corp.*, 502 F. Supp. 2d 477, 482 (W.D. Pa. 2007) (“Plaintiff and defendants are direct competitors in a two-supplier market. If plaintiff cannot prevent its only competitor’s continued infringement of its patent, the patent is of little value.”) (granting permanent injunction); *Johns Hopkins Univ. v. Datascope Corp.*, 513 F. Supp. 2d 578, 586 (D. Md. 2007) (granting permanent injunction where infringing product was plaintiffs’ “only competition” and “thus, its sale reduce[d] the [p]laintiffs’ market share”); *Transocean Offshore Deepwater Drilling, Inc. v. GlobalSantaFe Corp.*, Civ. No. 03-2910, 2006 WL 3813778, *4 (S.D. Tex. Dec. 27, 2006) (granting permanent injunction requiring structural modifications to infringing deepwater drilling rigs where “the customer base for deep water drill rigs is small, and [defendant] has not only used [its] rigs equipped with the infringing structure to compete for the same customers and contracts as [plaintiff], but also to win contracts over

also frequently succeed when their patented technology is at the core of their business, and/or where the market for the patented technology is volatile or still developing.²³

B. Analysis

1. Irreparable harm

Plaintiffs²⁴ and defendants are direct competitors, offering the only “high barrier” monolayer polyester barrier resins available in the market, PoliProtect and PolyShield.²⁵

competing bids from [plaintiff”].

²³ See *Martek Biosciences Corp. v. Nutrinova Inc.*, 520 F. Supp. 2d 537, 558–59 (D. Del. 2007) (granting permanent injunction where plaintiff was a direct competitor “likely to lose market share that it may not be able to recapture,” as plaintiff’s patented technology was its primary revenue source, and defendant was plaintiff’s only competitor and was “targeting [plaintiffs] customers in that industry”); *TiVo, Inc. v. EchoStar*, 446 F. Supp. 2d 664 (E.D. Tex. 2006) (granting permanent injunction where: (1) parties were direct competitors; (2) “plaintiff [was] losing market share at a critical time in the market’s development;” (3) the parties agreed that customers in the relevant market tend to remain customers of the company they first purchased from; and (4) as a “relatively new company with only one primary product,” plaintiff’s “primary focus is on growing a customer base specifically around the product” competing with the infringing product).

²⁴ Auriga is the exclusive licensee of the ‘216 patent, and the only company with rights to practice the ‘216 patent in the United States. Invista is the only company authorized to sell the PolyShield resin in Europe and the rest of the world. (D.I. 468 at 2-3)

²⁵ Plaintiffs introduce arguments (and sales figures) related to its Oxyclear barrier PET product. Plaintiffs argue that *Broadcom Corp. v. Qualcomm, Inc.*, 543 F.3d 683 (Fed. Cir. 2008), permits them to present this evidence of irreparable harm, as “Broadcom provided evidence of irreparable harm, despite the fact that it does not currently practice the claimed inventions.” *Id.* at 703. However, the Federal Circuit noted that the accused products “implement[ed] Broadcom’s patented features.” *Id.* By plaintiffs’ admission, this product is not a commercial embodiment of the ‘216 patent, therefore, the court does not address plaintiffs’ arguments related to Oxyclear. (D.I. 468 at 3-4; D.I. 481 at 12; D.I. 489 at 8)

The parties dispute what the relevant market is.²⁶ For the purposes of this analysis, the court considers the relevant market as the barrier polyester market, which includes monolayer, multilayer and coated containers. This market is a subset of the container market, which includes glass and metal containers. While the parties currently have the only monolayer products, each competes against other manufacturers of multilayer and coated products. The parties do not dispute that the monolayer products offer distinct advantages for the container industry.

Relying on *Apple, Inc. v. Samsung Electronics Co.*, 678 F.3d 1314 (Fed. Cir. 2012), defendants argue that the bi-component pellet feature of its PoliProtect products drives customer demand, as it makes the products more cost-effective for customers. *Id.* at 1325 (finding an insufficient nexus between competitor's design patent covering smartphone screen design and smartphone purchases to grant a preliminary injunction). However, the monolayer product sales are also driven by customers' need for high barrier properties, low yellowness and haze, which properties result from the claimed composition. Therefore, plaintiffs have evidenced a sufficient nexus between the alleged harm and infringement.

As a direct competitor, plaintiffs aver that they "will suffer irreparable injuries including lost sales and market share, the loss of research and development activities, a loss of goodwill in the market, and a forced loss of their patent exclusivity." (D.I. 468

²⁶Plaintiffs define the market as limited to monolayer PET containers or the barrier polyester market, which includes monolayer, multilayer and coated containers. (D.I. 468 at 3-4; D.I. 481 at 2) Defendants define it as including "businesses that sell glass containers, metal containers, coated containers, and multi-layer PET containers," as these businesses compete for the same customers. (D.I. 481 at 10-11)

at 5-6) Plaintiffs allege that the customer base for barrier polyester products in the United States is small, and the parties are competing for the developing beer market. Further, the major beer brewers in the United States “are beginning to transition to polyester beer bottles for the first time,” and this market is poised for significant growth. (*Id.* at 9-10) Moreover, plaintiffs “cannot presently be price-competitive” with defendants, because plaintiffs must pay royalties on PolyShield resin sold, under a license to certain of defendants’ patents. (D.I. 468 at 10-11) Customers could not readily switch to PolyShield at a later time, as customers would have to qualify²⁷ the resin for their products and purchase additional equipment. Plaintiffs apply the same arguments to the exportation of PoliProtect products manufactured in the United States and destined for export.^{28, 29} (*Id.* at 11-12)

While plaintiffs identify several examples of direct competition with defendants, including beer packaging in the U.S. and Europe (D.I. 489 at 2), both parties have presented evidence that customers must qualify the monolayer products and purchase

²⁷Such qualification is costly and takes about a year.

²⁸The court does not address plaintiffs’ arguments regarding its European litigation or that its “European business would be significantly and irreparably harmed if [defendants] were permitted an end-run around an injunction in Italy by exporting the PoliProtect products from the United States.” (D.I. 468 at 12) Therefore, the court does not take judicial notice of the Milan Court’s opinion as requested by defendants. (D.I. 525)

²⁹Defendants argue that they were not put on notice that plaintiffs intended to plead a count of § 271(f) with respect to the ‘216 patent, and, therefore, should not be able to enjoin the exportation of PoliProtect. (D.I. 481 at 13-14) However, plaintiffs’ amended complaint specifically requests a permanent injunction against, *inter alia*, “exporting out of the United States any products that infringe any claims of the patents-in-suit, including the PoliProtect APB and PoliProtect JB resins and food packaging articles. . . .” (D.I. 7 at 9)

specialized equipment in order to switch to using monolayer containers. (D.I. 468 at 10-11) Moreover, defendants argue that plaintiffs' current minimal United States sales are not due to the competition from PoliProtect, rather to other factors, such as plaintiffs' "refin[ing] the recipe for PolyShield ever since 2003 . . . and that [p]laintiffs have been unable to figure out how to make the base PolyShield resin in commercial volumes in the U.S. . . . , thus requiring them to purchase it from Invista in Europe and incur additional costs." (D.I. 481 at 9)

Plaintiffs also allege collateral harm resulting from defendants' infringing sales due to losses in its research and development program, inability to recoup its investment in its South Carolina manufacturing plant and loss of goodwill among its customers. (D.I. 468 at 12-13) A plaintiff's willingness to forego its patent rights for compensation, though certainly not dispositive, is one factor to consider with respect to whether plaintiff will suffer irreparable harm. *eBay*, 547 U.S. at 392-93 (rejecting categorical rule that patentee licensors can not demonstrate irreparable harm). Here, the parties dispute whether plaintiffs offered to license defendants to practice the '216 patent, with plaintiffs stating that the evidence reflects preliminary discussions in 2006 regarding two European patent applications. (D.I. 481 at 14-15; D.I. 489 at 8)

The parties' ongoing battle in the press regarding this action and another lawsuit is confusion of their own making. (D.I. 489 at 5-6; D.I. 502) The parties' arguments that each has made misstatements in the press and plaintiffs' subsequent claim that the press exchange damaged their goodwill does not ring true in this litigious era, and certainly cannot be the basis for a permanent injunction.

With only two manufacturers of monolayer products in the market, the court

concludes that "a sale to defendant is the loss of a sale to plaintiff." *TruePosition*, 568 F. Supp. 2d at 531. On the record at bar, irreparable harm has been established.

2. Remedies at law

Plaintiffs contend that legal remedies are not adequate compensation due to the irreparable injuries described above, "including lost sales and market share, lost market opportunities, loss of research and development activities, a loss of goodwill and reputation in the market, and a forced loss of their patent exclusivity," as each of these harms would be difficult to accurately quantify. (D.I. 468 at 15-16) Defendants disagree and aver that a loss of market share is measurable. (D.I. 481 at 9-10)

In March of 2011, plaintiffs sold the North American assets of Invista's Polymers and Resins business, which included "the exclusive right to manufacture, use, offer for sale, and sell PolyShield® resin and Oxyclear® barrier PET in the United States and the Americas, and the exclusive right to practice the '216 patent in those territories." This evidences that monetary damages may be measurable. However, in a head-to-head competition for any market share, plaintiffs are at a disadvantage. *Martek Biosciences Corp. v. Nutrinova Inc.*, 520 F. Supp. 2d 537, 558-59 (D. Del. 2007), rev'd on other grounds, 579 F.3d 1363 (Fed. Cir. 2009) (granting permanent injunction where plaintiff and defendant were direct competitors, supply agreements in the food and beverage industry are long-term, and plaintiff was "likely to lose market share that it may not be able to recapture"). The court concludes that this factor favors an injunction.

3. Balance of hardships

Plaintiffs argue that without an injunction, defendants will become plaintiffs' compulsory licensee. In light of defendants' infringement and the irreparable harm described above, plaintiffs argue that the balance of hardships weighs in their favor. (D.I. 468 at 15-16) Defendants respond that their business will be greatly harmed by an injunction, as it was found to not directly infringe. Therefore, defendants argue that they have a right to continue to manufacture their products. (D.I. 481 at 17) Defendants were found to indirectly infringe all of the asserted claims, as their customers mix the PoliProtect products, and thereby necessarily practice the '216 patent. The court concludes that the balance of hardships favors plaintiffs.

4. Public interest

As the asserted claims have been found valid and infringed, plaintiffs argue that the public interest in upholding plaintiffs' patent rights is significant and well recognized. (D.I. 468 at 17) Defendants argue the public interest will be hurt by the removal of an innovative competitive product, referencing their bi-component pellet. Customers will suffer the costs associated with qualifying a new product and the downtime associated with such qualification. (D.I. 481 at 17-18) Taking all factors into account, the court concludes that this factor is neutral.³⁰

For the aforementioned reasons, plaintiffs have demonstrated irreparable injury, as well as the inadequacy of money damages. Further, the hardship to plaintiffs outweighs that of defendants. Plaintiffs' motion for a permanent injunction is granted.

³⁰The court does not address defendants' argument related to unclean hands, as its motion for leave to file amended pleadings, on which the argument is based, is denied below. (D.I. 481 at 18-19)

VI. OTHER MOTIONS

A. Motion to Amend the Pleadings

The Federal Rules of Civil Procedure require courts to freely give leave to amend “when justice so requires.” Fed. R. Civ. P. 15(a)(2). The court may exercise its discretion to deny leave to amend in situations in which the moving party has delayed seeking leave and the delay “is undue, motivated by bad faith, or prejudicial to the opposing party.” *Bjorgung v. Whitetail Resort, LP*, 550 F.3d 263, 266 (3d Cir. 2008) (citation omitted). After a pleading deadline has passed, courts have required the movant to also satisfy the more rigorous “good cause” standard of Federal Rule of Civil Procedure 16(b)(4).³¹ See, e.g., *ICU Med. Inc. v. RyMed Techs., Inc.*, 674 F. Supp. 2d 574, 577-78 (D. Del. 2009); *Cordance Corp. v. Amazon.com, Inc.*, 255 F.R.D. 366, 371 (D. Del. 2009).

Defendants filed a second motion to amend the pleadings on June 19, 2013, less than one month before trial. (D.I. 365) As the motion was filed so close to trial, the parties agreed to suspend briefing until after trial. Defendants seek to add claims and defenses asserting that the three patents-in-suit are unenforceable based on inequitable conduct. Defendants’ first motion to amend the pleadings, filed August 6, 2012 (the last day to amend the pleadings) accused patent attorney Craig Sterner of perpetrating a fraud on the patent office. (D.I. 91) The court adopted Magistrate Judge Burke’s Report & Recommendation denying amendment for failure to state a claim for inequitable conduct. (D.I. 339; D.I. 350)

³¹Rule 16(b)(4) provides that a scheduling order “may be modified only for good cause and with the judge’s consent.”

In this motion, defendants accuse a different person, Dr. Scantlebury, Invista's Patent Liaison for the asserted patents, of inequitable conduct. Plaintiffs' production was substantially complete in May 2012 with Invista producing documents as late as September 28, 2012 and Auriga as late as October 11, 2012. (D.I. 366 at 2; D.I. 367 at ¶ 3; D.I. 449 at 1) Defendants deposed Dr. Scantlebury in August 2012 and all of the inventors were deposed by October 2012. "Good cause" exists when the [s]chedule cannot reasonably be met despite the diligence of the party seeking the extension." *ICU Med.*, 674 F. Supp. 2d at 577. Defendants argue that the motion was timely because of the volume of plaintiffs' production and the "complex factual allegations" involved in determining the inequitable conduct. Further, defendants aver that they worked diligently between the time of the issuance of the report and recommendation denying the first motion to amend on April 30, 2013 and the date of filing of this motion, June 19, 2013.

The court finds that defendants have not met the good cause requirement, as defendants have not offered sufficient explanation for their undue delay, filing their second round of inequitable conduct challenges a year after both the amendment deadline and Dr. Schantlebury's deposition. Moreover, defendants' allegations in its second motion were not vetted through the discovery process; therefore, allowing defendants to proceed would prejudice plaintiffs by requiring discovery, preparations, and additional costs. Defendants' motion to amend the pleadings is denied.

B. Motion for Reargument

Defendants request reconsideration of the court's oral order of July 16, 2013 overruling Magistrate Judge Burke's memorandum order which had granted

defendants' motion to compel certain Auriga produced documents. This motion was filed on July 30, 2013, a week after the jury trial. While defendants argue that the court "made an error not of reasoning but of apprehension," the court disagrees. Defendants have failed to demonstrate any of the appropriate grounds to warrant reconsideration. As such, the motion is denied.

C. Motions for Attorney fees

As the parties stipulated to stay briefing on the motions for attorney fees (D.I. 451; D.I. 452; D.I. 455) until such time as all of the issues were resolved (D.I. 476, so ordered), the court denies these motions without prejudice to renew at a later time.

VII. CONCLUSION

For the aforementioned reasons, defendants' renewed motions for JMOL on invalidity and non-infringement (D.I. 470; D.I. 473) are denied. Plaintiffs' motion for an injunction (D.I. 467) is granted. Defendants' motions for leave to file amended pleadings (D.I. 365) and reargument of the court's July 16, 2013 oral order (D.I. 444) are denied. The parties motions for attorney fees (D.I. 451; D.I. 452; D.I. 455) are denied without prejudice to renew. An appropriate order shall issue.

IN THE UNITED STATES DISTRICT COURT

FOR THE DISTRICT OF DELAWARE

INVISTA NORTH AMERICA S.À.R.L.)
and AURIGA POLYMERS INC.,)
)
Plaintiffs,)
)
v.) Civ. No. 11-1007-SLR-CJB
)
)
M&G USA CORPORATION and M&G)
POLYMERS USA, LLC,)
)
Defendants.)

O R D E R

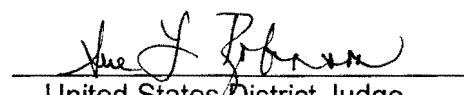
At Wilmington this 31st day of March, 2014, consistent with the memorandum opinion issued this same date;

IT IS ORDERED that:

1. Defendants' renewed motion for JMOL on invalidity (D.I. 470) is denied.
2. Defendants' renewed motion for JMOL on non-infringement (D.I. 473) is denied.
3. Plaintiffs' motion for an injunction (D.I. 467) is granted.
4. Defendants' motion for leave to file amended pleadings (D.I. 365) is denied.
5. Defendants' motion for reargument of the court's July 16, 2013 oral order (D.I. 444) is denied.
6. Invista's motion for attorney fees (D.I. 451) is denied without prejudice to renew.

7. Auriga's motion for attorney fees (D.I. 452) is denied without prejudice to renew.

8. Defendants' motion for attorney fees (D.I. 455) is denied without prejudice to renew.



United States District Judge

IN THE UNITED STATES DISTRICT COURT
FOR THE DISTRICT OF DELAWARE

INVISTA NORTH AMERICA S.À.R.L.)
and AURIGA POLYMERS INC.,)
)
Plaintiffs,)
)
v.) Civ. No. 11-1007-SLR-CJB
)
M&G USA CORPORATION and M&G)
POLYMERS USA, LLC,)
)
Defendants.)

**FINAL JUDGMENT FOLLOWING POST TRIAL MOTION PRACTICE
PURSUANT TO FED. R. CIV. P. 54 (b)**

For reasons stated in the court's memorandum opinion and order of March 31, 2014;

IT IS ORDERED AND ADJUDGED that judgment be and is hereby entered in favor of plaintiffs Invista North America S.à.r.l. and Auriga Polymers Inc. and against defendants M&G USA Corporation and M&G Polymers USA, LLC.



United States District Judge

Dated: 4/11/2014



(By) Deputy Clerk

IN THE UNITED STATES DISTRICT COURT

FOR THE DISTRICT OF DELAWARE

INVISTA NORTH AMERICA S.À.R.L.)
and AURIGA POLYMERS INC.,)
)
Plaintiffs,)
)
v.) Civ. No. 11-1007-SLR-CJB
)
M&G USA CORPORATION and M&G)
POLYMERS USA, LLC,)
)
Defendants.)

INJUNCTION ORDER

WHEREAS, judgment has been entered in favor of plaintiffs INVISTA North America S.à.r.l. and Auriga Polymers Inc.'s (collectively, "Invista") and against defendants M&G USA Corporation and M&G Polymers USA, LLC (collectively, "M&G") based on the finding of the court that M&G indirectly infringes U.S. Patent No. 7,943,216 ("the '216 patent") pursuant to 35 U.S.C. §§ 271(b) and (c) by manufacturing and selling its PoliProtect APB and PoliProtect JB resins; and

WHEREAS, although Invista did not specifically invoke 35 U.S.C. § 271(f) in connection with the '216 patent, Invista did ask in its complaint for an injunction permanently enjoining M&G from "inducing, contributing to, or otherwise causing the infringement of the patents-in-suit by making, using, selling, or offering to sell in the United States, importing into the United States, or **exporting out of the United States any products that infringe any claims of the patents-in-suit . . . , or by supplying or causing to be supplied any products that induce or contribute to the same by**

others, including third parties outside of the United States (D.I. 1 at 7) (emphasis added); and

WHEREAS, Invista has demonstrated that it will suffer irreparable harm if M&G is permitted to continue to manufacture and sell its PoliProtect APB and PoliProtect JB resins and the court has previously granted its motion for entry of a permanent injunction (D.I. 549; D.I. 550); and

WHEREAS, the imposition of an injunction is an equitable remedy meant to address wrongful conduct; and

WHEREAS, because there are no non-infringing uses of M&G's PoliProtect APB and PoliProtect JB resins,¹ Invista will be irreparably harmed if M&G manufactures such resins, regardless of who the customers are;

THEREFORE, at Wilmington this 21st day of April, 2014;

IT IS ORDERED that:

(1) M&G, and any of their affiliates, subsidiaries, successors, assigns, officers, agents, servants, employees, and attorneys, and those persons in active concert or participation with any or all of them are permanently enjoined from infringing the '216 patent by manufacturing, using, importing, selling, and/or offering to sell in the United States, or exporting from the United States, PoliProtect APB and PoliProtect JB resin; and,

(2) this order shall remain in effect until the expiration of the '216 patent.

IT IS FURTHER ORDERED that the injunction shall not go into effect for ten

¹The resins are made by M&G in pellet form and its customers melt the pellets to mold containers.

days, to allow M&G to file an immediate appeal with the United States Court of Appeals for the Federal Circuit.



United States District Judge



US007919159B2

(12) **United States Patent**
Liu et al.

(10) **Patent No.:** **US 7,919,159 B2**
(b5) **Date of Patent:** **Apr. 5, 2011**

(54)	METHOD TO MAKE SINGLE-LAYER PET BOTTLES WITH HIGH BARRIER AND IMPROVED CLARITY	5,623,047 A	4/1997	Yuo et al.
		5,639,815 A	6/1997	Cochran et al.
		5,650,459 A	7/1997	Long et al.
		5,866,649 A	2/1999	Hlong et al.
		5,955,527 A	9/1999	Cochran et al.
		6,083,585 A	7/2000	Cahill
		6,239,233 B1	5/2001	Bell et al.
		6,288,151 B1	9/2001	Kim et al.
		6,346,307 B1	2/2002	Al Ghatta et al.
		6,346,308 B1	2/2002	Cahill
		6,406,756 B1	6/2002	Rotter
		6,444,283 B1	9/2002	Turner et al.
		6,506,453 B1	1/2003	Cahill
		6,509,436 B1	1/2003	Cahill
		6,933,055 B2 *	8/2005	Share et al. 428/474.4
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		2003/0134956 A1	7/2003	Kim
		2004/0013833 A1 *	1/2004	Lee et al. 428/35.7

(21) Appl. No.: **10/569,614****FOREIGN PATENT DOCUMENTS**(22) PCT Filed: **Aug. 5, 2004**

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JP	02135259 *	5/1990
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(86) PCT No.: **PCT/US2004/025257****OTHER PUBLICATIONS**§ 371 (c)(1),
(2), (4) Date: **Feb. 24, 2006**

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* cited by examiner

(65) **Prior Publication Data**

US 2006/0246245 A1 Nov. 2, 2006

Primary Examiner — Ana L. Woodward(74) *Attorney, Agent, or Firm* — Craig M. Stern(51) **Int. Cl.****ABSTRACT***C08K 5/00* (2006.01)

The present invention comprises a blend of polyester and a partially aromatic polyamide with an ionic compatibilizer and a cobalt salt. This blend can be processed into a container that has both active and passive oxygen barrier and carbon dioxide barrier properties at an improved color and clarity than containers known in the art. The partially aromatic polyamide is preferably meta-xylylene adipamide. The ionic compatibilizer is preferably 5-sodiumsulfoisophthalic acid or 5-zincsulfoisophthalic acid, or their dialkyl esters such as the dimethyl ester (SIM) and glycol ester (SiPEG). The cobalt salt is selected from the class of cobalt acetate, cobalt carbonate, cobalt chloride, cobalt hydroxide, cobalt naphthenate, cobalt oleate, cobalt linoleate, cobalt octoate, cobalt stearate, cobalt nitrate, cobalt phosphate, cobalt sulfate, cobalt (ethylene glycolate), or mixtures of two or more of these. The partially aromatic polyamide is present in a range from about 1 to about 10 wt. % of said composition. The ionic compatibilizer is present in a range from about 0.1 to about 2.0 mol-% of said composition. The cobalt salt is present in a range from about 20 to about 500 ppm of said composition.

B32B 27/34 (2006.01)*B32B 27/08* (2006.01)*B65D 23/00* (2006.01)*B65D 23/02* (2006.01)(52) **U.S. Cl.** **428/34.1; 428/35.7; 428/36.9; 524/413; 524/435; 524/538; 525/425**(58) **Field of Classification Search** **524/413, 524/435, 538; 525/425; 428/34.1, 35.7, 428/36.9**

See application file for complete search history.

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5,258,233 A	11/1993	Mills et al.
5,266,413 A	11/1993	Mills et al.
5,281,360 A	1/1994	Hong et al.
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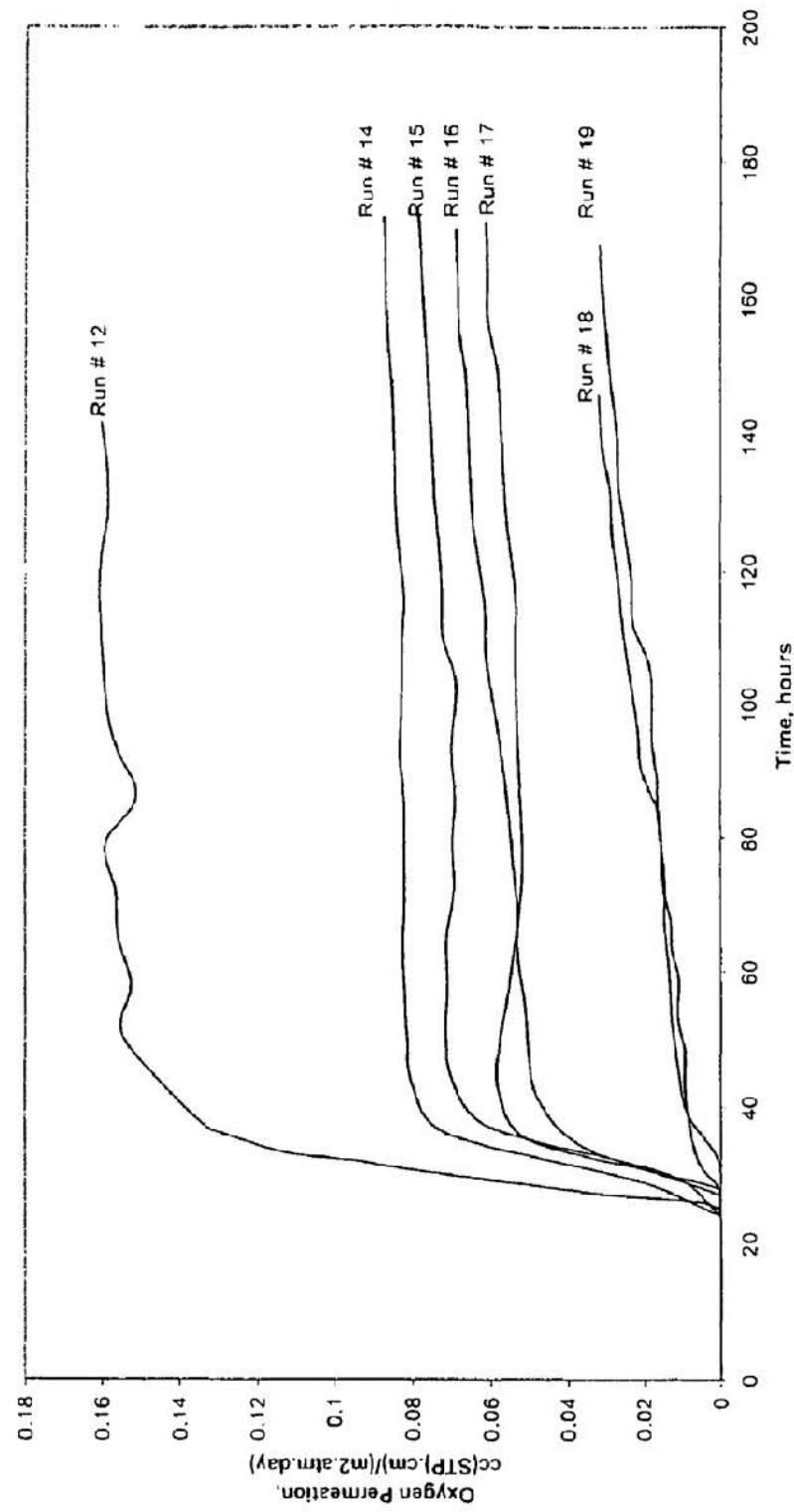
U.S. Patent

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Fig. 1



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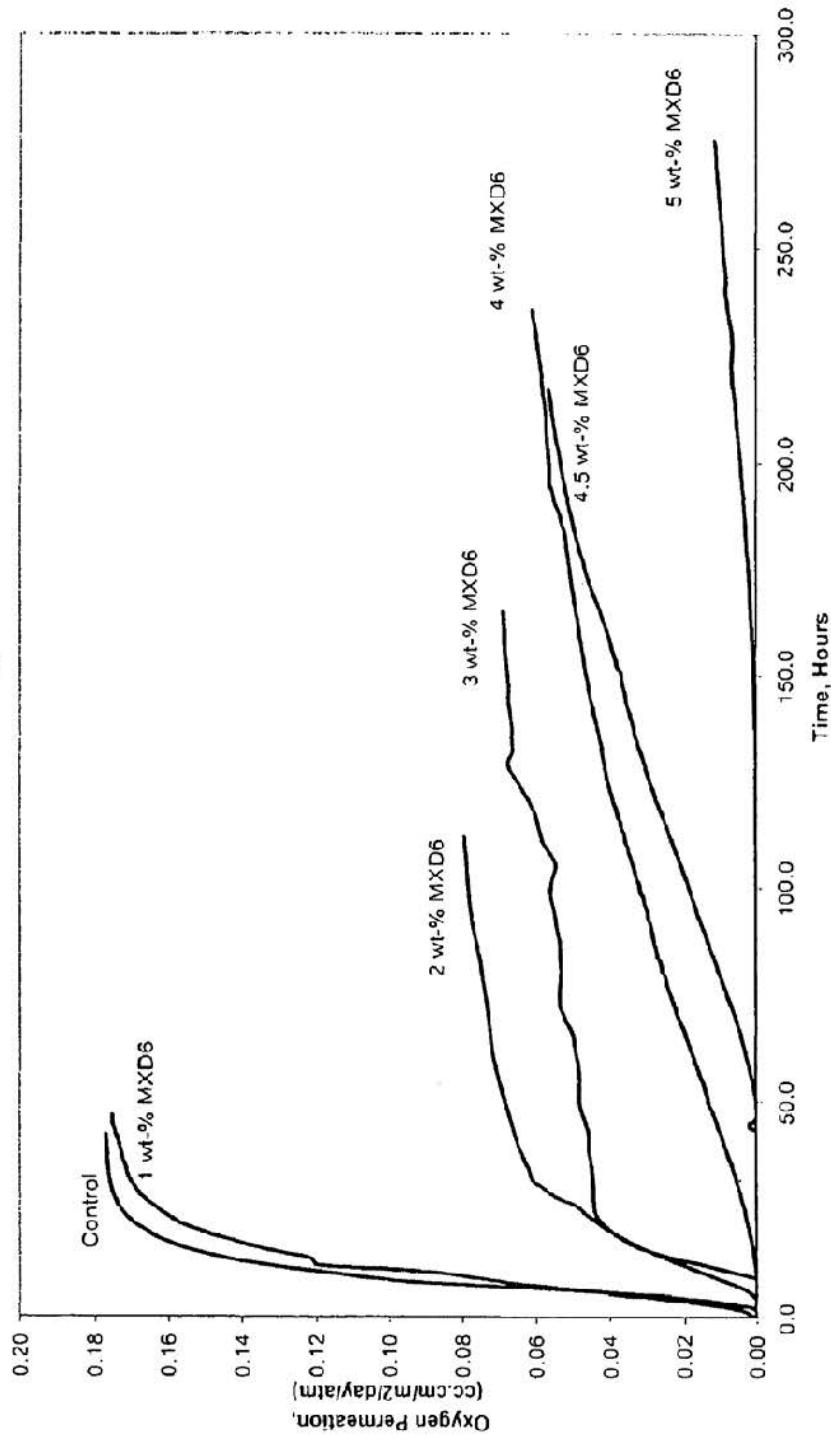
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Fig. 2



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METHOD TO MAKE SINGLE-LAYER PET BOTTLES WITH HIGH BARRIER AND IMPROVED CLARITY

BACKGROUND OF THE INVENTION

1) Field of the Invention

The invention relates to compatibilized blends of polyamides in polyesters, a method for forming such compositions, and to containers made from such compositions. Specifically the compositions have less yellowness than previous blends. The blends can be used as passive gas barriers, or active oxygen scavengers with the addition of a transition metal catalyst.

2) Prior Art

Plastic materials have been replacing glass and metal packaging materials due to their lighter weight, decreased breakage compared to glass, and potentially lower cost. One major deficiency with polyesters is its relatively high gas permeability. This restricts the shelf life of carbonated soft drinks and oxygen sensitive materials such as beer and fruit juices.

Multilayer bottles containing a low gas permeable polymer as an inner layer, with polyesters as the other layers, have been commercialized. Blends of these low gas permeable polymers into polyester have not been successful due to haze formed by the domains in the two-phase system. The preferred polyamide is a partially aromatic polyamide containing meta-xylylene groups, especially poly(m-xylylene adipamide), MXD6.

The MXD6 bulletin (TR No. 0009-E) from Mitsubishi Gas Chemical Company, Inc., Tokyo Japan, clearly shows that the haze of a multilayer bottle containing a layer of 5 wt-% MXD6 is -1% compared to 15% for a blend of the same 5 wt-%.

However, the use of partially aromatic polyamides as the low gas permeable polymer gives an increase in the yellowness of the resultant container.

U.S. Pat. No. 4,501,781 to Kushida et al. discloses a hollow blow-molded biaxially oriented bottle shaped container comprising a mixture of polyethylene terephthalate (PET) resin and a xylylene group-containing polyamide resin. Both monolayer and multilayer containers are disclosed, but there is no information on the color of the bottles.

U.S. Pat. No. 5,650,469 to Long et al. discloses the use of a terephthalic acid based polyester blended with low levels (0.05 to 2.0 wt-%) of a polyamide to reduce the acetaldehyde level of the container. These blends produced lower yellowness containers than a corresponding blend made from a dimethyl terephthalate based polyester, but are still unsatisfactory for the higher levels required to significantly lower (decrease) the gas permeability.

U.S. Pat. Nos. 5,258,233, 5,266,413 and 5,340,884 to Mills et al. discloses a polyester composition comprising 0.05 to 2.0 wt-% of low molecular weight polyamide. At a 0.5 wt-% blend of MXD6 the haze of the bottle increased from 0.7 to 1.2%. No gas permeation or color data is given.

U.S. Pat. No. 4,837,115 to Igashii et al. discloses a blend of amino terminated polyamides with PET to reduce acetaldehyde levels. There was no increase in haze with the addition of 0.5 wt-% MXD6, but at 2 wt-% the haze increased from 1.7 to 2.4%. No gas permeation or color data is given.

U.S. Pat. No. 6,239,233 to Bell et al. discloses a blend of acid terminated polyamides with PET that has reduced yellowness compared to amino terminated polyamides. No gas permeation data is given.

U.S. Pat. No. 6,346,307 to AlGhatta et al. discloses the use of a dianhydride of a tetracarboxylic acid to reduce the dis-

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persed domain size of a blend of MXD6 in PET. The examples did not give color data, but at a 10 wt-% MXD6 blend level the oxygen permeability was reduced from 0.53 to 0.12 ml/bottle/day/atm and the carbon dioxide permeability was reduced from 18.2 to 7.02 ml/bottle/day/atm.

U.S. Pat. No. 6,444,283 to Turner et al. discloses that low molecular weight MXD6 polyamides have lower haze than higher molecular weight MXD6 when blended with PET. The examples did not give color data, but at a 2 wt-% MXD6 (Mitsubishi Chemical Company grade 6007) the oxygen permeability of an oriented film was reduced from 8.1 to 5.7 cc-mil/100 in²-atm-day compared to 6.1 for the low molecular weight MXD6.

U.S. Pat. No. 4,957,980 to Koyayashi et al. discloses the use of maleic anhydride grafted copolymers to compatibilize polyester-MXD6 blends.

U.S. Pat. No. 4,499,262 to Fagerburg et al. discloses sulfoxide-modified polyesters that give an improved rate of acetaldehyde generation and a lower critical planar stretch ratio. Blends with polyamides were not discussed.

Japanese Pat. No. 2663578 B2 to Katsumasa et al. discloses the use of 0.5 to 10 mole % 5-sulfoisophthalate copolymers as compatibilizer of polyester-MXD6 blends. No color data was given.

The use of a transition metal catalyst to promote oxygen scavenging in polyamide multilayer containers, and blends with PET, has been disclosed in the following patents, for example.

U.S. Pat. Nos. 5,021,515, 5,639,815 and 5,955,527 to Cochran et al. disclose the use of a cobalt salt as the preferred transition metal catalyst and MXD6 as the preferred polyamide. There is no data on the color or haze of the polyamide blends.

U.S. Pat. Nos. 5,281,360 and 5,866,649 to Hong, and U.S. Pat. No. 6,288,161 to Kim discloses blends of MXD6 with PET and a cobalt salt catalyst. There is no data on the color or haze of the polyamide blends.

U.S. Pat. No. 5,623,047 to You et al. discloses the use of a catalyst composition containing an alkali metal acetate, preferably 30 ppm cobalt acetate to mask the yellowness in polyesters polymerized from terephthalic acid.

US Pat. Application 2003/0134966 A1 to Kim et al. discloses the use of cobalt octoate and xylylene group-containing polyamides for use in multi-layer extrusion blow-molding for improved clarity. Extrusion blow-molding minimizes the orientation of the polyamide domain size compared to injection stretch blow molding containers. No color data is given.

There is a need for an improved gas barrier polyester composition that can be injection stretch blow molded as a monolayer container that has reduced yellowness and adequate haze. This is particularly required for containers that require a long shelf life, such as beer and other oxygen sensitive materials. None of these patents disclose how this balance of properties can be achieved.

SUMMARY OF THE INVENTION

The present invention is an improvement over polyester/polyamide blends known in the art in that these compositions have reduced yellowness.

In the broadest sense the present invention comprises a compatibilized blend of polyester and a partially aromatic polyamide with an ionic compatibilizer and a cobalt salt.

The broadest scope of the present invention also comprises a container that has both active and passive oxygen barrier and carbon dioxide barrier properties at an improved color and clarity than containers known in the art.

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In the broadest sense the present invention also comprises a container in which the balance of gas barrier properties and color can be independently balanced.

In the broadest sense the present invention is a method to blend polyester and polyamides with an ionic compatibilizer and a cobalt salt.

BRIEF DESCRIPTION OF THE DRAWING

The drawing is to aid those skilled in the art in understanding the invention and is not meant to limit the scope of the invention in any manner beyond the scope of the claims.

FIG. 1 shows a graph of the oxygen permeation rate of selected runs of Example 3.

FIG. 2 shows a graph of the oxygen permeation rate of the runs of Example 4.

DETAILED DESCRIPTION OF THE INVENTION

Compositions of the present invention comprise: polyester, partially aromatic polyamide, ionic compatibilizer, and a cobalt salt.

Generally polyesters can be prepared by one of two processes, namely: (1) the ester process and (2) the acid process. The ester process is where a dicarboxylic ester (such as dimethyl terephthalate) is reacted with ethylene glycol or other diol in an ester interchange reaction. Because the reaction is reversible, it is generally necessary to remove the alcohol (methanol when dimethyl terephthalate is employed) to completely convert the raw materials into monomers. Certain catalysts are well known for use in the ester interchange reaction. In the past, catalytic activity was then sequestered by introducing a phosphorus compound, for example polyphosphoric acid, at the end of the ester interchange reaction. Primarily the ester interchange catalyst was sequestered to prevent yellowness from occurring in the polymer.

Then the monomer undergoes polycondensation and the catalyst employed in this reaction is generally an antimony, germanium or titanium compound, or a mixture of these.

In the second method for making polyester, an acid (such as terephthalic acid) is reacted with a diol (such as ethylene glycol) by a direct esterification reaction producing monomer and water. This reaction is also reversible like the ester process and thus to drive the reaction to completion one must remove the water. The direct esterification step does not require a catalyst. The monomer then undergoes polycondensation to form polyester just as in the ester process, and the catalyst and conditions employed are generally the same as those for the ester process.

For most container applications this melt phase polyester is further polymerized to a higher molecular weight by a solid state polymerization.

In summary, in the ester process there are two steps, namely: (1) an ester interchange, and (2) polycondensation. In the acid process there are also two steps, namely: (1) direct esterification, and (2) polycondensation.

Suitable polyesters are produced from the reaction of a diacid or diester component comprising at least 65 mol-% terephthalic acid or C₁-C₄ dialkylterephthalate, preferably at least 70 mol-%, more preferably at least 75 mol-%, even more preferably, at least 95 mol-%, and a diol component comprising at least 65% mol-% ethylene glycol, preferably at least 70 mol-%, more preferably at least 75 mol-%, even more preferably at least 95 mol-%. It is also preferable that the diacid component is terephthalic acid and the diol component is ethylene glycol, thereby forming polyethylene terephthalate

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(PET). The mole percent for all the diacid component totals 100 mol-%, and the mole percentage for all the diol component totals 100 mol-%.

Where the polyester components are modified by one or more diol components other than ethylene glycol, suitable diol components of the described polyester may be selected from 1,4-cyclohexanedimethanol, 1,2-propanediol, 1,4-butanediol, 2,2-dimethyl-1,3-propanediol, 2-methyl-1,3-propanediol (2MPDO) 1,6-hexanediol, 1,2-cyclohexanediol, 1,4-cyclohexanediol, 1,2-cyclohexanecimethanol, 1,3-cyclohexanediethanol, and diols containing one or more oxygen atoms in the chain, e.g., diethylene glycol, triethylene glycol, dipropylene glycol, tripropylene glycol or mixtures of these, and the like. In general, these diols contain 2 to 18, preferably 2 to 8 carbon atoms. Cycloaliphatic diols can be employed in their cis or trans configuration or as mixture of both forms. Preferred modifying diol components are 1,4-cyclohexanediethanol or diethylene glycol, or a mixture of these.

Where the polyester components are modified by one or more acid components other than terephthalic acid, the suitable acid components (aliphatic, alicyclic, or aromatic dicarboxylic acids) of the linear polyester may be selected, for example, from isophthalic acid, 1,4-cyclohexanedicarboxylic acid, 1,3-cyclohexanedicarboxylic acid, succinic acid, glutaric acid, adipic acid, sebatic acid, 1,12-dodecanedioic acid, 2,6-naphthalenedicarboxylic acid, bibenzoic acid, or mixtures of these and the like. In the polymer preparation, it is often preferable to use a functional acid derivative thereof such as the dimethyl, diethyl, or dipropyl ester of the dicarboxylic acid. The anhydrides or acid halides of these acids also may be employed where practical. These acid modifiers generally retard the crystallization rate compared to terephthalic acid.

Also particularly contemplated by the present invention is a modified polyester made by reacting at least 85 mol-% terephthalate from either terephthalic acid or dimethylterephthalate with any of the above comonomers.

In addition to polyester made from terephthalic acid (or dimethyl terephthalate) and ethylene glycol, or a modified polyester as stated above, the present invention also includes the use of 100% of an aromatic diacid such as 2,6-naphthalene dicarboxylic acid or bibenzoic acid, or their diesters, and a modified polyester made by reacting at least 85 mol-% of the dicarboxylate from these aromatic diacids/diesters with any of the above comonomers.

Preferably the polyamide used as the gas barrier component of the blend is selected from the group of partially aromatic polyamides which is the amide linkage contains at least one aromatic ring and a non-aromatic species. Preferred partially aromatic polyamides include: poly(m-xylylene adipamide); poly(hexamethylene isophthalamide); poly(hexamethylene adipamide-co-isophthalamide); poly(hexamethylene adipamide-co-terephthalamide); poly(hexamethylene isophthalamide-co-terephthalamide); or mixtures of two or more of these. The most preferred is poly(m-xylylene adipamide).

The preferred range of polyamide is 1 to 10% by weight of the composition depending on the required gas barrier required for the container.

The ionic compatibilizer is preferably a copolyester containing a metal sulfonate salt group. The metal ion of the sulfonate salt may be Na⁺, Li⁺, K⁺, Zn⁺⁺, Mn⁺⁺, Ca⁺⁺ and the like. The sulfonate salt group is attached to an aromatic acid nucleus such as a benzene, naphthalene, diphenyl, oxydiphenyl, sulfonyldiphenyl, or methylenediphenyl nucleus.

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Preferably, the aromatic acid nucleus is sulfophthalic acid, sulfoterephthalic acid, sulfoisophthalic acid, 4-sulfonaphthalene-2,7-dicarboxylic acid, and their esters. Most preferably, the sulfomonomer is 5-sodiumsulfoisophthalic acid or 5-zincsulfoisophthalic acid and most preferably their dialkyl esters such as the dimethyl ester (SIM) and glycol ester (SPEG). The preferred range of 5-sodiumsulfoisophthalic or 5-zincsulfoisophthalic acid to reduce the haze of the container is 0.1 to 2.0 mol-%.

Suitable cobalt compounds for use with the present invention include cobalt acetate, cobalt carbonate, cobalt chloride, cobalt hydroxide, cobalt naphthenate, cobalt oleate, cobalt linoleate, cobalt octoate, cobalt stearate, cobalt nitrate, cobalt phosphate, cobalt sulfate, cobalt (ethylene glycolate), and mixtures of two or more of these, among others. As a transition metal catalyst for active oxygen scavenging, a salt of a long chain fatty acid is preferred, cobalt octoate or stearate being the most preferred. For color control of passive gas barrier blends any cobalt compound can be used, with cobalt acetate being preferred.

It has surprisingly been found that the ionic compatibilizer, in addition to improving gas barrier properties and improving haze, in combination with a cobalt salt significantly reduces the yellowness of the resin, preform and container. The preferred range of Co for blends containing 1 to 10 wt-% partially aromatic polyamide and 0.1 to 2.0 mol-% of an ionic compatibilizer is 20 to 500 ppm.

Although not required, additives may be used in the polyester/polyamide blend. Conventional known additives include, but are not limited to an additive of a dye, pigment, filler, branching agent, reheat agent, anti-blocking agent, anti-oxidant, anti-static agent, biocide, blowing agent, coupling agent, flame retardant, heat stabilizer, impact modifier, UV and visible light stabilizer, crystallization aid, lubricant, plasticizer, processing aid, acetaldehyde and other scavengers, and slip agent, or a mixture thereof.

The blend of polyester, ionic compatibilizer, cobalt salt and partially aromatic polyamide is conveniently prepared by adding the components in the throat of the injection molding machine that produces a preform that can be stretch blow molded into the shape of the container. If a conventional polyester base resin designed for polyester containers is used, then one method is to prepare a master batch of a polyester containing the ionic compatibilizer, and optionally a transition metal catalyst for active scavenging, together with the partially aromatic polyamide using a gravimetric feeder for the three components. Alternatively the polyester resin can be polymerized with the ionic compatibilizer, and optionally a transition metal catalyst for active scavenging, to form a copolymer. This copolymer can be mixed at the injection molding machine with the partially aromatic nylon. Alternatively all the blend components can be blended together, or as a blend of master batches, and fed as a single material to the extruder. The mixing section of the extruder should be of a design to produce a homogeneous blend. This can be determined by measuring the thermal properties of the preform and observing a single glass transition temperature in contrast to two separate glass transition temperatures of the partially aromatic polyamide and polyester.

These process steps work well for forming carbonated soft drink, water or beer bottles, and containers for hot fill applications, for example. The present invention can be employed in any of the conventional known processes for producing a polyester container.

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Testing Procedures

1. Oxygen and Carbon Dioxide Permeability of Films, Passive

Oxygen flux of film samples, at zero percent relative humidity, at one atmosphere pressure, and at 25° C. was measured with a Mocon Ox-Tran model 2/20 (MOCON Minneapolis, Minn.). A mixture of 98% nitrogen with 2% hydrogen was used as the carrier gas, and 100% oxygen was used as the test gas. Prior to testing, specimens were conditioned in nitrogen inside the unit for a minimum of twenty-four hours to remove traces of atmospheric oxygen dissolved in the PET matrix. The conditioning was continued until a steady base line was obtained where the oxygen flux changed by less than one percent for a thirty-minute cycle. Subsequently, oxygen was introduced to the test cell. The test ended when the flux reached a steady state where the oxygen flux changed by less than 1% during a 30 minute test cycle. Calculation of the oxygen permeability was done according to a literature method for permeation coefficients for PET copolymers, from Fick's second law of diffusion with appropriate boundary conditions. The literature documents are: Sekelik et al., *Journal of Polymer Science Part B: Polymer Physics*, 1999, Volume 37, Pages 847-857. The second literature document is Qureshi et al., *Journal of Polymer Science Part B: Polymer Physics*, 2000, Volume 38, Pages 1679-1686. The third literature document is Polyakova, et al., *Journal of Polymer Science Part B: Polymer Physics*, 2001, Volume 39, Pages 1889-1899.

The carbon dioxide permeability of films was measured in the same manner, replacing the oxygen gas with carbon dioxide and using the Mocon Permatran-C 4/40 instrument.

All film permeability values are reported in units of (cc (STP)·cm)/(m²·atm·day)).

2. Oxygen Permeability of Films, Active Scavenger

The same method was used as for passive oxygen permeability above with the exception that the oxygen flux did not necessarily equilibrate to a steady state. After the introduction of the oxygen into the cell, the reduction in the amount of oxygen was measured from 0 to at least 350 hours. Treatment of the data generated an Apparent Permeation Coefficient (APC), as a function of time with oxygen exposure (cc(STP)·cm)/(m²·atm·day)). The generated APC data is not a steady state value in normal permeation coefficients. APC is data generated that describes oxygen permeation at a fixed point in time, even though this coefficient is changing slowly with time. These changes are too small to be detected during the time necessary for measuring their value at any fixed point in time. Calculation of the APC was done according to a literature method for permeation coefficients for PET copolymers, from Fick's second law of diffusion with appropriate boundary conditions, in the same manner as described for passive barrier permeability.

3. Carbon Dioxide Permeability of Bottles.

Carbon dioxide permeability of bottles was measured using a MOCON Permatran C-200 CO₂ Permeation System. Tests were conducted at 22° C. The bottles were purged with nitrogen and then pressurized with CO₂ at a pressure of 60 psi (4.01 MPa). The bottles were left in ambient conditions for 3 days and the pressure measured. Bottles in which the pressure had dropped below 56 psi (3.75 MPa) were rejected, otherwise the bottles were repressurized to 60 psi (4.01 MPa) and placed in the testing chamber, which has been purged with nitrogen for at least 5 hours. After a day, measurements of the CO₂ in the test chamber were taken over a 30 minute time frame, over an eight hour time period. The nitrogen flow rate to the sensor was 100 cm³/min, and to the carrier stream was 460 cm³/min. Results are reported as cm³/bottle/day.

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4. Intrinsic Viscosity (IV)

Intrinsic viscosity (IV) is determined by dissolving 0.2 grams of an amorphous polymer composition in 20 milliliters of dichloroacetic acid at a temperature of 25°C. and using an Ubbelohde viscometer to determine the relative viscosity (RV). RV is converted to IV using the equation: IV = [(RV - 1) × 0.691] + 0.063.

5. Color

The haze of the preform and bottle walls was measured with a Hunter Lab ColorQuest II instrument. D65 illuminant was used with a CIE 1964 10° standard observer. The haze is defined as the percent of the CIE Y diffuse transmittance to the CIE Y total transmission. The color of the preform and bottle walls was measured with the same instrument and is reported using the CIELAB color scale, L* is a measure of brightness, a* is a measure of redness (+) or greenness (-) and b* is a measure of yellowness (+) or blueness (-).

6. Diethylene Glycol (DEG)

The DEG (diethylene glycol) content of the polymer is determined by hydrolyzing the polymer with an aqueous solution of ammonium hydroxide in a sealed reaction vessel at 220±5°C. for approximately two hours. The liquid portion of the hydrolyzed product is then analyzed by gas chromatography. The gas chromatography apparatus is a FID Detector (HP5890, HP7673A) from Hewlett Packard. The ammonium hydroxide is 28 to 30% by weight ammonium hydroxide from Fisher Scientific and is reagent grade.

7. Isophthalic and Naphthalene Dicarboxylic Acid

The percent isophthalic acid and naphthalene dicarboxylic acid present in the amorphous polymer was determined at 285 nanometers using a Hewlett Packard Liquid Chromatograph (HPLC) with an ultraviolet detector. An amorphous polymer sample was hydrolyzed in diluted sulfuric acid (10 ml acid in 1 liter deionized water) in a stainless steel bomb at 230°C. for 3 hours. After cooling, an aqueous solution from the bomb was mixed with three volumes of methanol (HPLC grade) and an internal standard solution. The mixed solution was introduced into the HPLC for analysis.

8. Metal Content

The metal content of the ground polymer samples was measured with an Atom Scan 16 ICP Emission Spectrograph. The sample was dissolved by heating in ethanamine, and on cooling, distilled water was added to crystallize out the terephthalic acid. The solution was centrifuged, and the supernatant liquid analyzed. Comparison of atomic emissions from the samples under analysis with those of solutions of known metal ion concentrations was used to determine the experimental values of metals retained in the polymer samples. The concentration of sulfur was used to calculate the concentration of metal sulfonate in the ionic compatibilizer.

9. Preform and Bottle Process

After solid state polymerization, the resin of the present invention is typically, dried for 4-6 hours at 170-180°C., melted and extruded into preforms. Each preform for a 0.59 liter soft drink bottle, for example, employs about 24 grams of the resin. The preform is then heated to about 100-120°C. and blown-molded into a 0.59 liter contour bottle at a stretch ratio of about 12.5. The stretch ratio is the stretch in the radial direction times the stretch in the length (axial) direction. Thus if a preform is blown into a bottle, it may be stretched about two times its length and stretched about six times its diameter giving a stretch ratio of twelve (2×6). Since the bottle size is fixed, different preform sizes can be used for obtaining different stretch ratios.

10. Scanning Electron Micrograph

Films were prepared by compression molding by heating at 275°C. in a press for 3 minutes without pressure, then the

pressure was cycled several times between 0 and 300 psi and then held at 300 psi for 4 minutes. The film was quenched in ice water. These films were notched with a razor blade on the film surface to facilitate a brittle failure, immersed in liquid nitrogen for 15 minutes, removed and fractured by hand perpendicular to the thickness direction. Fracture surfaces were coated with 100 angstrom of gold and were observed using a JEOL 840A scanning electron microscope.

The following examples are given to illustrate the present invention, and it shall be understood that these examples are for the purposes of illustration and are not intended to limit the scope of the invention.

EXAMPLES

15 Various polyester (PET) resins reflecting typical commercial recipes were produced. Comonomers included isophthalic acid (or its dimethyl ester) (IPA) and diethylene glycol (DEG) as crystallization retardants and naphthalene dicarboxylic acid (or its dimethyl ester) (NDC) to improve the temperature at which a container can be filled.

20 Amorphous polyester was first produced with an IV of about 0.6, this was then solid phase polymerized to the final resin IV. The additives used were, manganese acetate, zinc acetate, cobalt acetate, antimony trioxide and poly-phosphoric acid. The analyses of these resins are set forth in Table 1.

TABLE 1

	Resin Identification			
	A	B	C	D
Process	TA	DMT	DMT	DMT
IV	0.83	0.82	0.84	0.81
IPA, wt-%	2.5	3.1	0	0
NDC, wt-%	0	0	5	5
DEG, wt-%	1.5	0.7	0.6	0.6
Cobalt, ppm	30	40	100	0

30 A series of copolymers were made containing various amounts of 5-sulfoisophthalic acid (SIPA), either the ester or the glycolate of SIPA was used. The melt phase polymerization was conducted in the normal way, but the amorphous resin was not solid state polymerized for resin S3. In the case of Resin S1, zinc acetate was used in place of manganese acetate as the ester-interchange catalyst. The analyses of these resins are set forth in Table 2.

TABLE 2

	Resin Identification		
	S1	S2	S3
Process	DMT	DMT	DMT
IV	0.84	0.82	0.56
SIPA, mol-%	0.11	1.3	1.7
Cobalt, ppm	0	0	40

50 A master batch of the cobalt salt to be used as the transition metal catalyst for active oxygen scavenging was made by late addition of 2 wt-% cobalt octoate to a polyester prepared using 75 ppm Zn (as zinc acetate), 250 ppm Sb (as antimony trioxide), 60 ppm P (as poly-phosphoric acid) and 2.5 wt-% IPA. This material had an IV of 0.35-0.40.

55 Unless otherwise stated the partially aromatic nylon used in the blend was Type 6007 from Mitsubishi Gas Chemical, Tokyo Japan. Type 6007 has a number average molecular weight of 25,900 and its melt viscosity at 271°C. and 1000 sec⁻¹ is 280 Pa·s.

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Unless otherwise stated the preforms were prepared on an Arburg injection molding machine using 24 g of material, and blown into a 0.59 liter contour bottle on a Sidel SBO2 stretch blow molding machine. The bottle sidewall thickness is about 0.25 mm.

Example 1

The effect of the interaction of SIPA with Co on the yellowness of preforms and bottles was studied by blending either polyester resin D or S1 with the cobalt master batch and MXD6. The yellowness value (b*) of the preforms and bottle sidewalls are set forth in Table 3 (lower or negative b* values correspond to less yellowness).

TABLE 3

Run No.	Resin	Co, ppm	MXD6, wt-%	SIPA, mol-%	Preform b*	Delta ¹	Bottle b*	Delta ²
1	D	0	0	0	11	Control	3.6	Control
2	D	0	5	0	19.3	8.3	7.1	3.5
3	D	100	0	0	0.7	-10.3	1	-2.5
4	D	200	5	0	4.2	-6.8	3.5	-0.1
5	S1	0	0	0.11	16.3	Control	4.6	Control
6	S1	0	5	0.11	17.5	1.2	5.5	0.9
7	S1	100	0	0.11	-0.8	-17.1	1.1	-3.5
8	S1	200	5	0.11	-6.6	-22.9	2	-2.5

¹Difference in b* of the preform compared to the control.

²Difference in b* of the bottle compared to the control.

This table shows that the cobalt salt, at a 200 ppm level, will more than offset the yellowness due to a blend with 5 wt-% MXD6, but more importantly, in the presence of 0.11 mol-% SIPA, there is a synergistic effect and the Co salt is markedly more effective in offsetting the yellowness.

Example 2

A similar trial was conducted using resin C as the control and the results set forth in Table 4.

TABLE 4

Run No.	Resin	Co, ppm	MXD6, wt-%	SIPA, mol-%	Preform b*	Bottle b*
9	C	100	0	0	-0.1	1.2
10	C	200	5	0	3.6	5.7
11	S1	200	5	0.11	-3.5	3.6

The haze of these preforms and bottle sidewalls are set forth in Table 5.

TABLE 5

Run No.	Resin	Co, ppm	MXD6, wt-%	SIPA, mol-%	Preform haze, %	Bottle haze, %
9	C	100	0	0	9.5	1.3
10	C	200	5	0	16.4	13.9
11	S1	200	5	0.11	14.3	8.2

The results again show the synergistic effect of the ionic compatibilizer on the cobalt salt as a means to reduce yellowness, in addition the ionic compatibilizer reduced the haze of the bottle sidewall containing 5 wt-% MXD6.

Example 3

Another trial was conducted in which the amount of MXD6 was varied at a constant SIPA level of 0.11 mol-%, and the results set forth in Table 6

10

TABLE 6

Run No.	Resin	Co, ppm	MXD6, wt-%	SIPA, mol-%	Preform b*	Bottle b*
5	12	C	100	0	0	0.4
	13	S1	100	0	0.11	-1.8
	14	C	200	3	0	1.4
	15	S1	200	3	0.11	-7.4
10	16	C	200	4	0	1.0
	17	S1	200	4	0.11	-7.8
	18	C	200	5	0	3.2
	19	S1	200	5	0.11	-6.1

At all levels of MXD6 the incorporation of an ionic compatibilizer reduced the yellowness.

15 The oxygen permeability of the bottle sidewalls was measured and the results plotted in FIG. 1. This shows that the ionic compatibilizer decreases the permeability at each MXD6 concentration. Surprisingly there is a non-linear relationship of oxygen permeability with MXD6 concentration with extremely low values at 5 wt-% MXD6.

Example 4

20 In order to better define the oxygen permeability as a function of MXD6 concentration a series of blends were prepared using polyester A as the base resin. The concentration of MXD6 used was 1, 2, 3, 4, 4.5 and 5 wt-%, each containing 100 ppm cobalt octoate. The oxygen permeability of the bottle sidewalls was measured and the results shown in FIG. 2.

25 This illustrates that there is a surprising reduction in oxygen permeability between 4.5 and 5 wt-% MXD6.

Example 5

30 Another trial was run in which the level of MXD6 was held constant at 5 wt-% and the concentration of SIPA changed, the results are set forth in Table 7. In these runs the base polyester resin was A and the master batch of SIPA polymer S2 was used.

TABLE 7

Run No.	Resins	Co, ppm	MXD6, wt-%	SIPA, mol-%	Preform b*	Bottle b*
45	20	A	30	0	0	3.8
	21	A	130	5	0	4.1
	22	A/S2	130	5	0.13	-2.5
	23	A/S2	130	5	0.26	-2.9
50	24	A/S2	130	5	0.65	-3.6
	25	S2	100	5	1.5	-9.1

55 These results show that the ionic compatibilizer can be used as a master batch to obtain the synergistic reduction of yellowness with cobalt, as well as a copolymer that was used in the previous Examples 1-3.

Example 6

60 Instead of using sodium as the SIPA salt, a copolyester using the divalent zinc ester was made using the process that was used for copolymer S1. Since this Zn copolyester was more yellow than S1 no comparison of the relative difference between Na-SIPA and Zn-SIPA can be given. However the haze of bottle sidewalls made with PEI resin A as the control, using 0.11 mol-% SIPA (the runs containing MXD6 contained 100 ppm Co) are compared in Table 8 below.

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TABLE 8

Run No.	MXD6, wt-%	SIPA type	Haze, %
26	0	none	5.5
27	5	none	14.2
28	5	Na	12.0
29	5	Zn	9.6

It would appear that the divalent ionic compatibilizer is more effective than the monovalent in reducing the bottle sidewall haze.

Example 7

A low molecular weight MXD6 was prepared. A mixture of 438 g of adipic acid, 428.4 g of m-xylenediamine and 500 g of deionized water were charged in a 2-liter autoclave under nitrogen atmosphere. The mixture was stirred for 15 minutes then heated to reflux for 30 minutes. Water was distilled off and the temperature was increased to 275° C. over a period of 60-90 minutes. The mixture was stirred at 275° C. for 30 minutes before extrusion. This polymer had a viscosity of 9.5 Pas at 1000 sec⁻¹ and 271° C. (compared to 280 Pas for the commercial 6007).

The procedure of Example 3 was followed, using this low molecular weight MXD6 (LMW) compared to the commercial 6007. The results are set forth in Table 9.

TABLE 9

Run No.	Resin	Co, ppm	MXD6 type	MXD6, wt-%	SIPA, mol-%	Preform b*	Bottle b*
32	C	200	6007	3	0	2.0	2.5
33	C	200	LMW	3	0	3.4	2.1
34	C	200	6007	5	0	4.2	3.5
35	C	200	LMW	5	0	1.1	3.6
36	S1	200	6007	5	0.11	-5.1	2.6
37	S1	200	LMW	5	0.11	-5.6	2.0

This illustrates that the color is better (less yellow) with the low molecular weight MXD6 than 6007.

The haze of these runs was also measured and the results set forth in Table 10 below.

TABLE 10

Run No.	Resin	Co, ppm	MXD6 Type	MXD6, wt-%	SIPA, mol-%	Preform Haze, %	Bottle Haze, %
32	C	200	6007	3	0	50.3	16.9
33	C	200	LMW	3	0	48.3	7.7
34	C	200	6007	5	0	50.1	14.0
35	C	200	LMW	5	0	49.9	11.8
36	S1	200	6007	5	0.11	49.3	11.1
37	S1	200	LMW	5	0.11	45.4	7.4

The use of the lower molecular MXD6 in conjunction with SIPA markedly reduces the haze of the bottle sidewalls.

Example 7

In order to determine the effect of the ionic compatibilizer on MXD6 domain size, a series of films were prepared and fractured. PE1 resin B was used together with blends with the S3 SIPA copolyester and 6007 MXD6. The domain size was measured and the results set forth in Table 11.

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TABLE 11

Run No.	MXD6, wt-%	SIPA, mol-%	Domain size, μm
5	10	0	0.8-1.5
	20	0	2.2-4.5
	20	1.35	0.2-0.5
	10	0.03	0.5-1.5
	10	0.08	0.5-1.5
	10	0.16	0.2-0.5

10 This shows that at a low level of SIPA, less than 0.2 mol-%, the domain size of a blend containing 10 wt-% MXD6 is reduced to less than 0.5 μm .

Example 8

15 A series of bottles were produced using C as the base PET resin, the S3 SIPA copolyester and 6007 MXD6. The passive oxygen permeability, at 0% Relative Humidity, of the bottle sidewalls was measured and the results set forth in Table 12.

TABLE 12

Run No.	MXD6, wt-%	SIPA, mol-%	O ₂ Permeability (cc(STP) · cm)/(m ² · atm · day)
25	38	0	0.180
	39	2.5	0.181
	40	2.5	0.164
	41	5	0.138
	42	5	0.131
30	43	5	0.143
	44	10	0.079
	45	10	0.054
	46	10	0.051

35 This shows that the ionic compatibilizer is improving the oxygen gas barrier at a given MXD6 level, possibly due to the reduction in domain size, which increases the number of domains, as shown in Example 7.

Example 9

40 Following the procedure of Example 7 a polyamide was produced in which 12% of the adipic acid was replaced with isophthalic acid. The melt viscosity of this polyamide at 171° C. and 1000 sec⁻¹ was 237 Pas. This polyamide was blended at a 5 wt-% level with PET resin C and ionic compatibilizer S3 to give a level of SIPA of 0.6 mol-% in the blend. Bottles were prepared from this blend and the oxygen permeation rate measures at 0.155 (cc(STP) · cm)/(m² · atm · day). This can be compared with a lower oxygen permeation rate of 0.145 measured on run 43 achieved with 5 wt-% MXD6.

Example 10

45 The carbon dioxide transmission rate of 0.5 liter bottles made from PET resin A were measured to be 8.6 cc/bottle/day. The addition of 5 wt-% MXD6 decreased this rate to 4.5 cc/bottle/day.

Example 11

50 Master batches using cobalt stearate and cobalt naphthenate in place of cobalt octoate were prepared using the same method as described above for cobalt octoate. Using PET base resin D, bottles were prepared using different amounts of MXD6 and different concentrations of cobalt octoate, cobalt stearate and cobalt naphthenate. The bottle wall oxygen per-

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meability was measured and the value after 100 hours (at this time the rate is at equilibrium, see FIG. 1) is set forth in Table 13.

TABLE 13

Run No.	MXD6, wt-%	Cobalt salt	Co, ppm	Oxygen Permeability @ 100 hours, (cc(STP)/cm ² ·atm·day)
47	0	—	—	0.150
48	1.75	Octoate	200	0.098
49	1.75	Octoate	400	0.120
50	1.75	Stearate	100	0.098
51	1.75	Stearate	200	0.122
52	3.0	Octoate	400	0.120
53	3.0	Octoate	60	0.048
54	5.0	Octoate	100	0.005
55	5.0	Stearate	30	0.005
56	5.0	Stearate	50	<0.005
57	5.0	Naphthenate	50	<0.005

An excess of the transition metal catalyst can in fact act as an anti-oxidant and increase the oxygen permeability, compare runs 48 and 49, runs 52 and 53.

Although particular embodiments of the invention have been described in detail, it will be understood that the invention is not limited correspondingly in scope, but include all changes and modifications coming within the spirit and terms of the claims appended hereto.

What is claimed is:

1. A composition for containers comprising: polyester, partially aromatic polyamide, ionic compatibilizer, and a cobalt salt; wherein said ionic compatibilizer is a copolyester containing a metal sulfonate salt.
2. The composition of claim 1, wherein said partially aromatic polyamide is present in a range from about 1 to about 10 wt. % of said composition.
3. The composition of claim 1, wherein said ionic compatibilizer is present in a range from about 0.1 to about 2.0 mole % of said composition.
4. The composition of claim 1, wherein said cobalt salt is present in a range from about 20 to about 500 ppm of said composition.
5. The composition of claim 1, wherein said partially aromatic polyamide contains meta-xylylene.
6. The composition of claim 5, wherein said partially aromatic polyamide is poly(meta-xylylene adipamide).
7. The composition of claim 1, wherein said partially aromatic polyamide is selected from the group consisting of poly(hexamethylene isophthalamide), poly(hexamethylene adipamide-co-isophthalamide), poly(hexamethylene adipamide-co-terephthalamide), poly(hexamethylene isophthalamide-co-terephthalamide), and mixtures of two or more of these.
8. The composition of claim 1, wherein said cobalt salt is selected from the group consisting of cobalt acetate, cobalt carbonate, cobalt chloride, cobalt hydroxide, cobalt naphthenate, cobalt oleate, cobalt linoleate, cobalt octoate, cobalt stearate, cobalt nitrate, cobalt phosphate, cobalt sulfate, cobalt (ethylene glycolate), and mixtures of two or more of these.
9. The composition of claim 1, wherein the metal ion of the metal sulfonate salt is selected from the group consisting of Na⁺, Li⁺, K⁺, Zn⁺⁺, Mn⁺⁺, and Ca⁺⁺.
10. The composition of claim 9, wherein said metal sulfonate salt is attached to an aromatic acid nucleus selected from the group consisting of sulfophthalic acid, sulfoterephthalic acid, sulfoisophthalic acid, 4-sulfonaphthalene-2,7-dicarboxylic acid, and esters thereof.

thalic acid, sulfoisophthalic acid, 4-sulfonaphthalene-2,7-dicarboxylic acid, and esters of each.

11. The composition of claim 1, wherein said metal sulfonate salt is 5-sodiumsulfoisophthalic acid, 5-zincsulfoisophthalic acid, or dialkyl esters thereof.

12. The composition of claim 11 wherein the dialkyl ester is a dimethyl ester (SIM) or a glycol ester (SIPEG).

13. An article comprising a composition comprising polyester, partially aromatic polyamide, ionic compatibilizer, and a cobalt salt;

14. The article of claim 13, wherein said partially aromatic polyamide is present in a range from about 1 to about 10 wt. % of said composition.

15. The article of claim 13, wherein said ionic compatibilizer is present in a range from about 0.1 to about 2.0 mole % of said composition.

16. The article of claim 13, wherein said cobalt salt is present in a range from about 20 to about 500 ppm of said composition.

17. The article of claim 13, wherein said partially aromatic polyamide contains meta-xylylene.

18. The article of claim 17, wherein said partially aromatic polyamide is poly(meta-xylylene adipamide).

19. The article of claim 13, wherein said partially aromatic polyamide is selected from the group consisting of poly(hexamethylene isophthalamide), poly(hexamethylene adipamide-co-isophthalamide), poly(hexamethylene adipamide-co-terephthalamide), poly(hexamethylene isophthalamide-co-terephthalamide), and mixtures of two or more of these.

20. The article of claim 13, wherein said cobalt salt is selected from the group consisting of cobalt acetate, cobalt carbonate, cobalt chloride, cobalt hydroxide, cobalt naphthenate, cobalt oleate, cobalt linoleate, cobalt octoate, cobalt stearate, cobalt nitrate, cobalt phosphate, cobalt sulfate, cobalt (ethylene glycolate), and mixtures of two or more of these.

21. The article of claim 13, wherein the metal ion of the metal sulfonate salt is selected from the group consisting of Na⁺, Li⁺, K⁺, Zn⁺⁺, Mn⁺⁺, and Ca⁺⁺.

22. The article of claim 21, wherein said metal sulfonate salt is attached to an aromatic acid nucleus selected from the group consisting of sulfophthalic acid, sulfoterephthalic acid, sulfoisophthalic acid, 4-sulfonaphthalene-2,7-dicarboxylic acid, and esters thereof.

23. The article of claim 13, wherein said metal sulfonate salt is 5-sodiumsulfoisophthalic acid, 5-zincsulfoisophthalic acid, or dialkyl esters thereof.

24. The article of claim 23 wherein the dialkyl ester is a dimethyl ester (SIM) or a glycol ester (SIPEG).

25. A polyester container having an oxygen permeation rate of <0.01 cc(STP)/cm²·atm·day after 100 hours in oxygen, wherein said container comprises a composition of polyester, partially aromatic polyamide, ionic compatibilizer, and a cobalt salt; wherein said ionic compatibilizer is a copolyester containing a metal sulfonate salt.

26. The container of claim 25, having a yellowness value (b*) of less than 2.5.

27. A polyester container that has a carbon dioxide transmission rate of less than 7 cc/bottle/day, based on a 0.59 liter bottle, wherein said container comprises a composition of polyester, partially aromatic polyamide, ionic compatibilizer, and a cobalt salt; wherein said ionic compatibilizer is a copolyester containing a metal sulfonate salt.

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(12) **United States Patent**
Liu et al.

(10) **Patent No.:** **US 7,943,216 B2**
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(54) **METHOD TO MAKE SINGLE-LAYER PET BOTTLES WITH HIGH BARRIER AND IMPROVED CLARITY**

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(60) Provisional application No. 60/498,311, filed on Aug. 26, 2003.

(51) **Int. Cl.**

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(52) **U.S. Cl.** **428/34.1; 428/35.7; 428/36.9; 524/413; 524/435; 524/538; 525/425**

(58) **Field of Classification Search** **525/425; 524/413, 435, 538; 428/34.1, 35.7, 36.9**

See application file for complete search history.

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(57) **ABSTRACT**

The present invention comprises a blend of polyester and a partially aromatic polyamide with an ionic compatibilizer and a cobalt salt. This blend can be processed into a container that has both active and passive oxygen barrier and carbon dioxide barrier properties at an improved color and clarity than containers known in the art. The partially aromatic polyamide is preferably meta-xylylene adipamide. The ionic compatibilizer is preferably 5-sodiumsulfoisophthalic acid or 5-zincsulfoisophthalic acid, or their dialkyl esters such as the dimethyl ester (SIM) and glycol ester (SIEG). The cobalt salt is selected from the class of cobalt acetate, cobalt carbonate, cobalt chloride, cobalt hydroxide, cobalt naphthenate, cobalt oleate, cobalt linoleate, cobalt octate, cobalt stearate, cobalt nitrate, cobalt phosphate, cobalt sulfate, cobalt (ethylene glycolate), or mixtures of two or more of these. The partially aromatic polyamide is present in a range from about 1 to about 10 wt. % of said composition. The ionic compatibilizer is present in a range from about 0.1 to about 2.0 mol-% of said composition. The cobalt salt is present in a range from about 20 to about 500 ppm of said composition.

15 Claims, 2 Drawing Sheets

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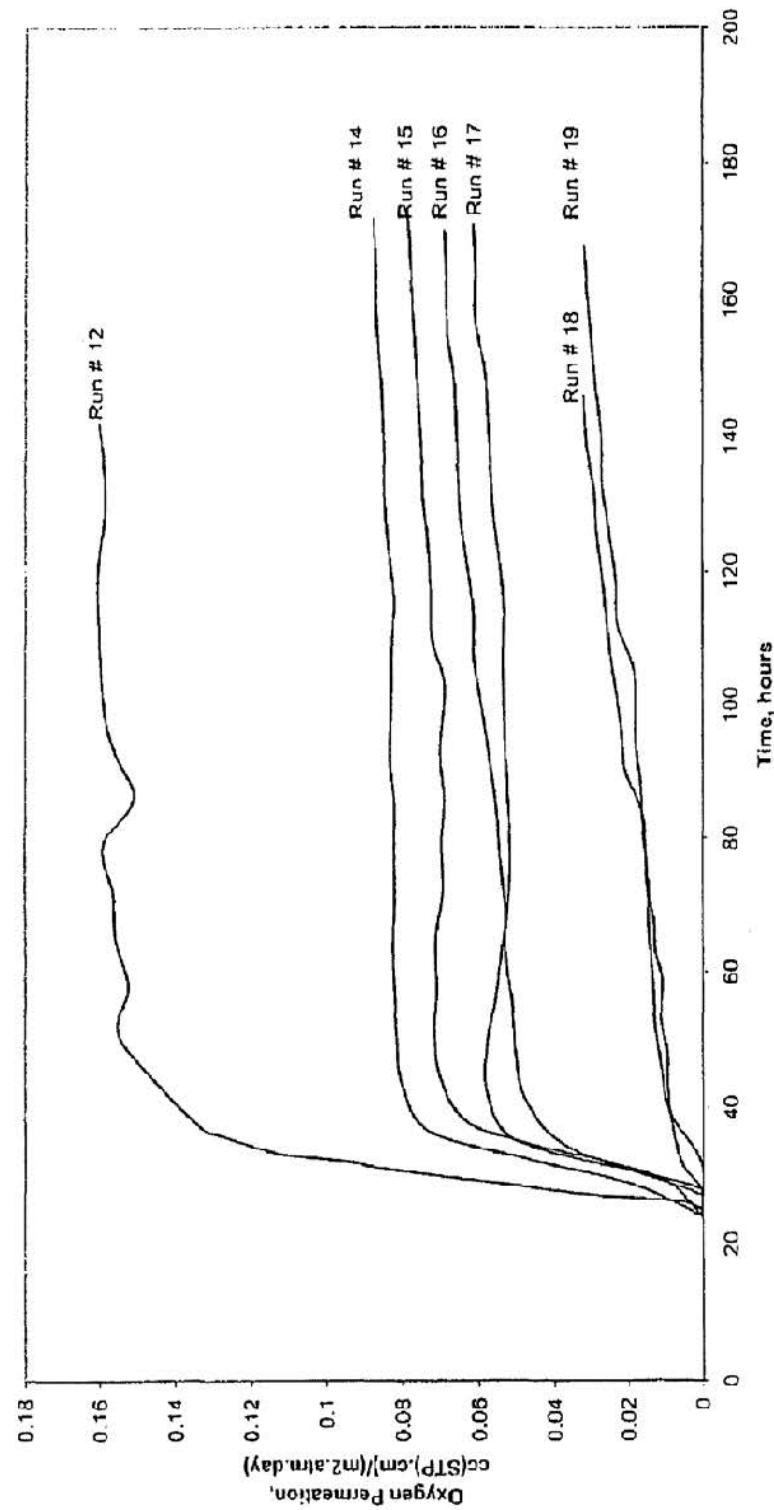
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Fig. 1



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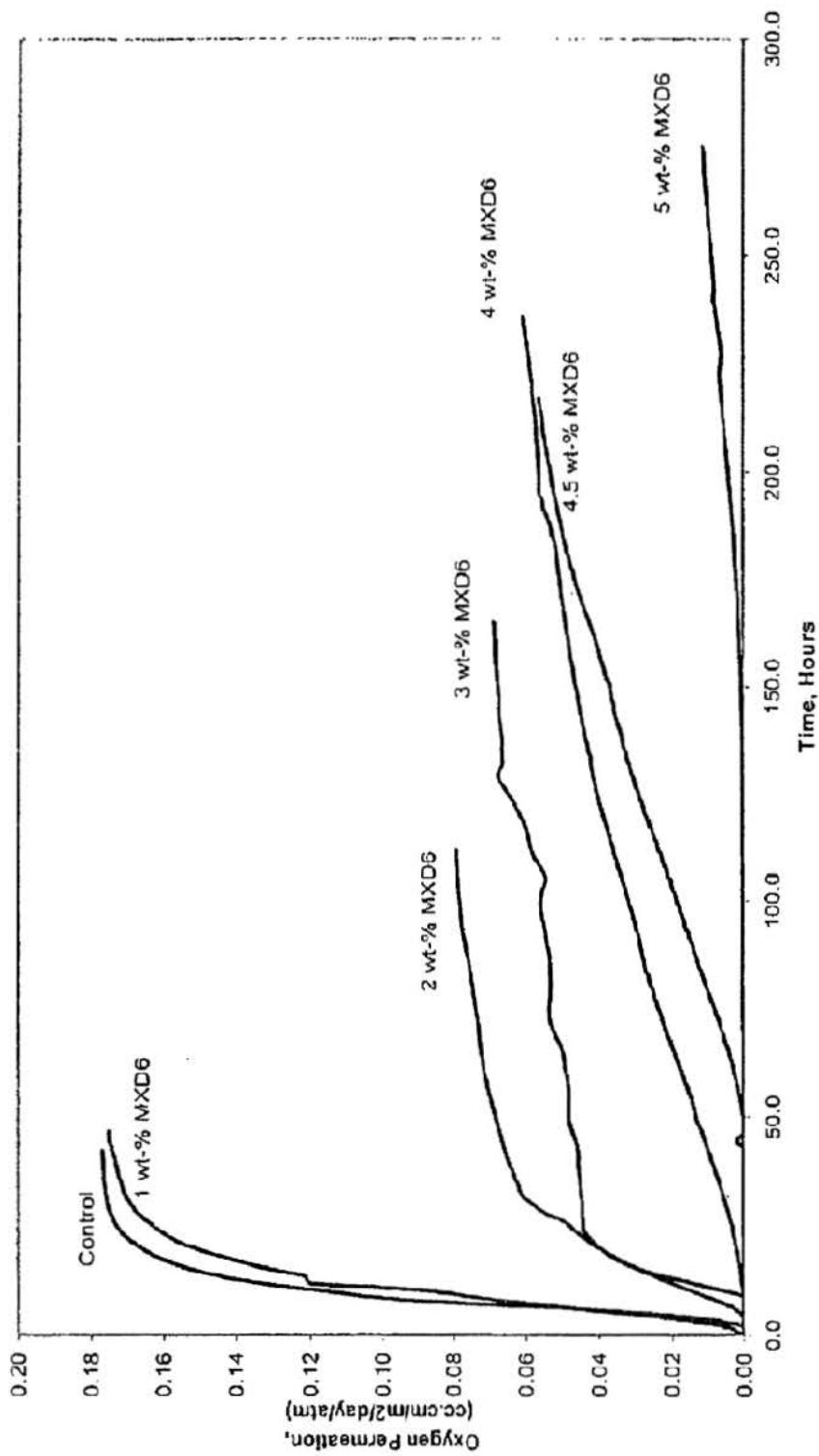
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Fig. 2



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METHOD TO MAKE SINGLE-LAYER PET BOTTLES WITH HIGH BARRIER AND IMPROVED CLARITY

CROSS REFERENCE TO RELATED APPLICATION

This application is a division of U.S. patent application Ser. No. 10/569,614 filed Feb. 24, 2006; which is a 371 of PCT/US04/25257 filed Aug. 5, 2004; which claims benefit of priority from U.S. Provisional Application Ser. No. 60/498,311 filed Aug. 26, 2003.

BACKGROUND OF THE INVENTION

1) Field of the Invention

The invention relates to compatibilized blends of polyamides in polyesters, a method for forming such compositions, and to containers made from such compositions. Specifically the compositions have less yellowness than previous blends. The blends can be used as passive gas barriers, or active oxygen scavengers with the addition of a transition metal catalyst.

2) Prior Art

Plastic materials have been replacing glass and metal packaging materials due to their lighter weight, decreased breakage compared to glass, and potentially lower cost. One major deficiency with polyesters is its relatively high gas permeability. This restricts the shelf life of carbonated soft drinks and oxygen sensitive materials such as beer and fruit juices.

Multilayer bottles containing a low gas permeable polymer as an inner layer, with polyesters as the other layers, have been commercialized. Blends of these low gas permeable polymers into polyester have not been successful due to haze formed by the domains in the two-phase system. The preferred polyamide is a partially aromatic polyamide containing meta-xylylene groups, especially poly (m-xylylene adipamide), MXD6.

The MXD6 bulletin (TR No. 0009-E) from Mitsubishi Gas Chemical Company, Inc., Tokyo Japan, clearly shows that the haze of a multilayer bottle containing a layer of 5 wt-% MXD6 is ~1% compared to 15% for a blend of the same 5 wt-%.

However, the use of partially aromatic polyamides as the low gas permeable polymer gives an increase in the yellowness of the resultant container.

U.S. Pat. No. 4,501,781 to Kushida et al. discloses a hollow blow-molded biaxially oriented bottle shaped container comprising a mixture of polyethylene terephthalate (PET) resin and a xylylene group-containing polyamide resin. Both monolayer and multilayer containers are disclosed, but there is no information on the color of the bottles.

U.S. Pat. No. 5,650,469 to Long et al. discloses the use of a terephthalic acid based polyester blended with low levels (0.05 to 2.0 wt-%) of a polyamide to reduce the acetaldehyde level of the container. These blends produced lower yellowness containers than a corresponding blend made from a dimethyl terephthalate based polyester, but are still unsatisfactory for the higher levels required to significantly lower (decrease) the gas permeability.

U.S. Pat. Nos. 5,258,233, 5,266,413 and 5,340,884 to Mills et al. discloses a polyester composition comprising 0.05 to 2.0 wt-% of low molecular weight polyamide. At a 0.5 wt-% blend of MXD6 the haze of the bottle increased from 0.7 to 1.2%. No gas permeation or color data is given.

U.S. Pat. No. 4,837,115 to Igarashi et al. discloses a blend of amino terminated polyamides with PET to reduce acetal-

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dehyde levels. There was no increase in haze with the addition of 0.5 wt-% MXD6, but at 2 wt-% the haze increased from 1.7 to 2.4%. No gas permeation or color data is given.

U.S. Pat. No. 6,239,233 to Bell et al. discloses a blend of acid terminated polyamides with PET that has reduced yellowness compared to amino terminated polyamides. No gas permeation data is given.

U.S. Pat. No. 6,346,307 to Al Ghatta et al. discloses the use of a dianhydride of a tetracarboxylic acid to reduce the dispersed domain size of a blend of MXD6 in PET. The examples did not give color data, but at a 10 wt-% MXD6 blend level the oxygen permeability was reduced from 0.53 to 0.12 ml/bottle/day/atm and the carbon dioxide permeability was reduced from 18.2 to 7.02 ml/bottle/day/atm.

U.S. Pat. No. 6,444,283 to Turner et al. discloses that low molecular weight MXD6 polyamides have lower haze than higher molecular weight MXD6 when blended with PET. The examples did not give color data, but at a 2 wt-% MXD6 (Mitsubishi Chemical Company grade 6007) the oxygen permeability of an oriented film was reduced from 8.1 to 5.7 cc mil/100 in² atm day compared to 6.1 for the low molecular weight MXD6.

U.S. Pat. No. 4,957,980 to Koyayashi et al. discloses the use of maleic anhydride grafted copolymers to compatibilize polyester-MXD6 blends.

U.S. Pat. No. 4,499,262 to Fagerburg et al. discloses sulfo-modified polyesters that give an improved rate of acetaldehyde generation and a lower critical planar stretch ratio. Blends with polyamides were not discussed.

Japanese Pat. No. 2663578 B2 to Katsumasa et al. discloses the use of 0.5 to 10 mole % 5-sulfoisophthalate copolymers as compatibilizer of polyester-MXD6 blends. No color data was given.

The use of a transition metal catalyst to promote oxygen scavenging in polyamide multilayer containers, and blends with PET, has been disclosed in the following patents, for example.

U.S. Pat. Nos. 5,021,515, 5,639,815 and 5,955,527 to Cochran et al. disclose the use of a cobalt salt as the preferred transition metal catalyst and MXD6 as the preferred polyamide. There is no data on the color or haze of the polyamide blends.

U.S. Pat. Nos. 5,281,360 and 5,866,649 to Hong, and U.S. Pat. No. 6,288,161 to Kim discloses blends of MXD6 with PET and a cobalt salt catalyst. There is no data on the color or haze of the polyamide blends.

U.S. Pat. No. 5,623,047 to You et al. discloses the use of a catalyst composition containing an alkali metal acetate, preferably 30 ppm cobalt acetate to mask the yellowness in polyesters polymerized from terephthalic acid.

US Pat. Application 2003/0134966 A1 to Kim et al. discloses the use of cobalt octoate and xylene group-containing polyamides for use in multi-layer extrusion blow-molding for improved clarity. Extrusion blow-molding minimizes the orientation of the polyamide domain size compared to injection stretch blow molding containers. No color data is given.

There is a need for an improved gas barrier polyester composition that can be injection stretch blow molded as a monolayer container that has reduced yellowness and adequate haze. This is particularly required for containers that require a long shelf life, such as beer and other oxygen sensitive materials. None of these patents disclose how this balance of properties can be achieved.

SUMMARY OF THE INVENTION

65 The present invention is an improvement over polyester/polyamide blends known in the art in that these compositions have reduced yellowness.

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In the broadest sense the present invention comprises a compatibilized blend of polyester and a partially aromatic polyamide with an ionic compatibilizer and a cobalt salt.

The broadest scope of the present invention also comprises a container that has both active and passive oxygen barrier and carbon dioxide barrier properties at an improved color and clarity than containers known in the art.

In the broadest sense the present invention also comprises a container in which the balance of gas barrier properties and color can be independently balanced.

In the broadest sense the present invention is a method to blend polyester and polyamides with an ionic compatibilizer and a cobalt salt.

The drawing is to aid those skilled in the art in understanding the invention and is not meant to limit the scope of the invention in any manner beyond the scope of the claims.

FIG. 1 shows a graph of the oxygen permeation rate of selected runs of Example 3.

FIG. 2 shows a graph of the oxygen permeation rate of the runs of Example 4.

DETAILED DESCRIPTION OF THE INVENTION

Compositions of the present invention comprise: polyester, partially aromatic polyamide, ionic compatibilizer, and a cobalt salt.

Generally polyesters can be prepared by one of two processes, namely: (1) the ester process and (2) the acid process. The ester process is where a dicarboxylic ester (such as dimethyl terephthalate) is reacted with ethylene glycol or other diol in an ester interchange reaction. Because the reaction is reversible, it is generally necessary to remove the alcohol (methanol when dimethyl terephthalate is employed) to completely convert the raw materials into monomers. Certain catalysts are well known for use in the ester interchange reaction. In the past, catalytic activity was then sequestered by introducing a phosphorus compound, for example polyphosphoric acid, at the end of the ester interchange reaction. Primarily the ester interchange catalyst was sequestered to prevent yellowness from occurring in the polymer.

Then the monomer undergoes polycondensation and the catalyst employed in this reaction is generally an antimony, germanium or titanium compound, or a mixture of these.

In the second method for making polyester, an acid (such as terephthalic acid) is reacted with diol (such as ethylene glycol) by a direct esterification reaction producing monomer and water. This reaction is also reversible like the ester process and thus to drive the reaction to completion one must remove the water. The direct esterification step does not require a catalyst. The monomer then undergoes polycondensation to form polyester just as in the ester process, and the catalyst and conditions employed are generally the same as those for the ester process.

For most container applications this melt phase polyester is further polymerized to a higher molecular weight by a solid state polymerization.

In summary, in the ester process there are two steps, namely: (1) an ester interchange, and (2) polycondensation. In the acid process there are also two steps, namely: (1) direct esterification, and (2) polycondensation.

Suitable polyesters are produced from the reaction of a diacid or diester component comprising at least 65 mol-% terephthalic acid or C₁-C₄ dialkylterephthalate, preferably at least 70 mol-%, more preferably at least 75 mol-%, even more preferably, at least 95 mol-%, and a diol component comprising at least 65% mol-% ethylene glycol, preferably at least 70 mol-%, more preferably at least 75 mol-%, even more pref-

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erably at least 95 mol-%. It is also preferable that the diacid component is terephthalic acid and the diol component is ethylene glycol, thereby forming polyethylene terephthalate (PET). The mole percent for all the diacid component totals 100 mol-%, and the mole percentage for all the diol component totals 100 mol-%.

Where the polyester components are modified by one or more diol components other than ethylene glycol, suitable diol components of the described polyester may be selected from 1,4-cyclohexanedimethanol, 1,2-propanediol, 1,4-butanediol, 2,2-dimethyl-1,3-propanediol, 2-methyl-1,3-propanediol (2MPDO), 1,6-hexanediol, 1,2-cyclohexanediol, 1,4-cyclohexanediol, 1,2-cyclohexanedimethanol, 1,3-cyclohexanediol, and diols containing one or more oxygen atoms in the chain, e.g., diethylene glycol, triethylene glycol, dipropylene glycol, tripropylene glycol or mixtures of these, and the like. In general, these diols contain 2 to 18, preferably 2 to 8 carbon atoms. Cycloaliphatic diols can be employed in their cis or trans configuration or as mixture of both forms. Preferred modifying diol components are 1,4-cyclohexanedimethanol or diethylene glycol, or a mixture of these.

Where the polyester components are modified by one or more acid components other than terephthalic acid, the suitable acid components (aliphatic, alicyclic, or aromatic dicarboxylic acids) of the linear polyester may be selected, for example, from isophthalic acid, 1,4-cyclohexanedicarboxylic acid, 1,3-cyclohexanedicarboxylic acid, succinic acid, glutaric acid, adipic acid, sebacic acid, 1,12-dodecanedioic acid, 2,6-naphthalenedicarboxylic acid, bibenzoic acid, or mixtures of these and the like. In the polymer preparation, it is often preferable to use a functional acid derivative thereof such as the dimethyl, diethyl, or dipropyl ester of the dicarboxylic acid. The anhydrides or acid halides of these acids also may be employed where practical. These acid modifiers generally retard the crystallization rate compared to terephthalic acid.

Also particularly contemplated by the present invention is a modified polyester made by reacting at least 85 mol-% terephthalate from either terephthalic acid or dimethylterephthalate with any of the above comonomers.

In addition to polyester made from terephthalic acid (or dimethyl terephthalate) and ethylene glycol, or a modified polyester as stated above, the present invention also includes the use of 100% of an aromatic diacid such as 2,6-naphthalene dicarboxylic acid or bibenzoic acid, or their diesters, and a modified polyester made by reacting at least 85 mol-% of the dicarboxylate from these aromatic diacids/diesters with any of the above comonomers.

Preferably the polyamide used as the gas barrier component of the blend is selected from the group of partially aromatic polyamides in which the amide linkage contains at least one aromatic ring and a non-aromatic species. Preferred partially aromatic polyamides include: poly(m-xylylene adipamide); poly(hexamethylene isophthalamide); poly(hexamethylene adipamide-co-isophthalamide); poly(hexamethylene adipamide-co-terephthalamide); poly(hexamethylene isophthalamide-co-terephthalamide); or mixtures of two or more of these. The most preferred is poly(m-xylylene adipamide).

The preferred range of polyamide is 1 to 10% by weight of the composition depending on the required gas barrier required for the container.

The ionic compatibilizer is preferably a copolyester containing a metal sulfonate salt group. The metal ion of the sulfonate salt may be Na⁺, Li⁺, K⁺, Zn⁺⁺, Mn⁺⁺, Ca⁺⁺ and the like. The sulfonate salt group is attached to an aromatic

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acid nucleus such as a benzene, naphthalene, diphenyl, oxy-diphenyl, sulfonyldiphenyl, or methylenediphenyl nucleus.

Preferably, the aromatic acid nucleus is sulfoisophthalic acid, sulfoisophthalic acid, sulfoisophthalic acid, 4-sulfonaphthalene-2,7-dicarboxylic acid, and their esters. Most preferably, the sulfomonomer is 5-sodiumsulfoisophthalic acid or 5-zincsulfoisophthalic acid and most preferably their dialkyl esters such as the dimethyl ester (SIM) and glycol ester (SPEG). The preferred range of 5-sodiumsulfoisophthalic or 5-zincsulfoisophthalic acid to reduce the haze of the container is 0.1 to 2.0 mol-%.

Suitable cobalt compounds for use with the present invention include cobalt acetate, cobalt carbonate, cobalt chloride, cobalt hydroxide, cobalt naphthenate, cobalt oleate, cobalt linoleate, cobalt octoate, cobalt stearate, cobalt nitrate, cobalt phosphate, cobalt sulfate, cobalt (ethylene glycolate), and mixtures of two or more of these, among others. As a transition metal catalyst for active oxygen scavenging, a salt of a long chain fatty acid is preferred, cobalt octoate or stearate being the most preferred. For color control of passive gas barrier blends any cobalt compound can be used, with cobalt acetate being preferred.

It has surprisingly been found that the ionic compatibilizer, in addition to improving gas barrier properties and improving haze, in combination with a cobalt salt significantly reduces the yellowness of the resin, preform and container. The preferred range of Co for blends containing 1 to 10 wt-% partially aromatic polyamide and 0.1 to 2.0 mol-% of an ionic compatibilizer is 20 to 500 ppm.

Although not required, additives may be used in the polyester/polyamide blend. Conventional known additives include, but are not limited to an additive of a dye, pigment, filler, branching agent, reheat agent, anti-blocking agent, anti-oxidant, anti-static agent, biocide, blowing agent, coupling agent, flame retardant, heat stabilizer, impact modifier, UV and visible light stabilizer, crystallization aid, lubricant, plasticizer, processing aid, acetaldehyde and other scavengers, and slip agent, or a mixture thereof.

The blend of polyester, ionic compatibilizer, cobalt salt and partially aromatic polyamide is conveniently prepared by adding the components in the throat of the injection molding machine that produces a preform that can be stretch blow molded into the shape of the container. If a conventional polyester base resin designed for polyester containers is used, then one method is to prepare a master batch of a polyester containing the ionic compatibilizer, and optionally a transition metal catalyst for active scavenging, together with the partially aromatic polyamide using a gravimetric feeder for the three components. Alternatively the polyester resin can be polymerized with the ionic compatibilizer, and optionally a transition metal catalyst for active scavenging, to form a copolymer. This copolymer can be mixed at the injection molding machine with the partially aromatic nylon. Alternatively all the blend components can be blended together, or as a blend of master batches, and fed as a single material to the extruder. The mixing section of the extruder should be of a design to produce a homogeneous blend. This can be determined by measuring the thermal properties of the preform and observing a single glass transition temperature in contrast to two separate glass transition temperatures of the partially aromatic polyamide and polyester.

These process steps work well for forming carbonated soft drink, water or beer bottles, and containers for hot fill applications, for example. The present invention can be employed in any of the conventional known processes for producing a polyester container.

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Testing Procedures

1. Oxygen and Carbon Dioxide Permeability of Films, Passive

Oxygen flux of film samples, at zero percent relative humidity, at one atmosphere pressure, and at 25° C. was measured with a Mocon Ox-Tran model 2/20 (MOCON Minneapolis, Minn.). A mixture of 98% nitrogen with 2% hydrogen was used as the carrier gas, and 100% oxygen was used as the test gas. Prior to testing, specimens were conditioned in nitrogen inside the unit for a minimum of twenty-four hours to remove traces of atmospheric oxygen dissolved in the PET matrix. The conditioning was continued until a steady base line was obtained where the oxygen flux changed by less than one percent for a thirty-minute cycle. Subsequently, oxygen was introduced to the test cell. The test ended when the flux reached a steady state where the oxygen flux changed by less than 1% during a 30 minute test cycle. Calculation of the oxygen permeability was done according to a literature method for permeation coefficients for PET copolymers, from Fick's second law of diffusion with appropriate boundary conditions. The literature documents are: Sekelik et al., *Journal of Polymer Science Part B: Polymer Physics*, 1999, Volume 37, Pages 847-857. The second literature document is Qureshi et al., *Journal of Polymer Science Part B: Polymer Physics*, 2000, Volume 38, Pages 1679-1686. The third literature document is Polyakova, et al., *Journal of Polymer Science Part B: Polymer Physics*, 2001, Volume 39, Pages 1889-1899.

The carbon dioxide permeability of films was measured in the same manner, replacing the oxygen gas with carbon dioxide and using the Mocon Permatran-C 4/40 instrument.

All film permeability values are reported in units of (cc (STP)·cm)/(m²·atm·day)).

2. Oxygen Permeability of Films, Active Scavenger.

The same method was used as for passive oxygen permeability above with the exception that the oxygen flux did not necessarily equilibrate to a steady state. After the introduction of the oxygen into the cell, the reduction in the amount of oxygen was measured from 0 to at least 350 hours. Treatment of the data generated an Apparent Permeation Coefficient (APC), as a function of time with oxygen exposure (cc(STP)·cm)/(m²·atm·day)). The generated APC data is not a steady state value in normal permeation coefficients. APC is data generated that describes oxygen permeation at a fixed point in time, even though this coefficient is changing slowly with time. These changes are too small to be detected during the time necessary for measuring their value at any fixed point in time. Calculation of the APC was done according to a literature method for permeation coefficients for PET copolymers, from Fick's second law of diffusion with appropriate boundary conditions, in the same manner as described for passive barrier permeability.

3. Carbon Dioxide Permeability of Bottles.

Carbon dioxide permeability of bottles was measured using a MOCON Permatran C-200 CO₂ Permeation System. Tests were conducted at 22° C. The bottles were purged with nitrogen and then pressurized with CO₂ at a pressure of 60 psi (4.01 MPa). The bottles were left in ambient conditions for 3 days and the pressure measured. Bottles in which the pressure had dropped below 56 psi (3.75 MPa) were rejected, otherwise the bottles were repressurized to 60 psi (4.01 MPa) and placed in the testing chamber, which has been purged with nitrogen for at least 5 hours. After a day, measurements of the CO₂ in the test chamber were taken over a 30 minute time frame, over an eight hour time period. The nitrogen flow rate to the sensor was 100 cm³/min, and to the carrier stream was 460 cm³/min. Results are reported as cm³/bottle/day.

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4. Intrinsic Viscosity (IV)

Intrinsic viscosity (IV) is determined by dissolving 0.2 grams of an amorphous polymer composition in 20 milliliters of dichloroacetic acid at a temperature of 25°C. and using an Ubbelohde viscometer to determine the relative viscosity (RV). RV is converted to IV using the equation: IV=[(RV-1)×0.691]+0.063.

5. Color

The haze of the preform and bottle walls was measured with a Hunter Lab ColorQuest II instrument. D65 illuminant was used with a CIE 1964 10° standard observer. The haze is defined as the percent of the CIE Y diffuse transmittance to the CIE Y total transmission. The color of the preform and bottle walls was measured with the same instrument and is reported using the CIELAB color scale, L* is a measure of brightness, a* is a measure of redness (+) or greenness (-) and b* is a measure of yellowness (+) or blueness (-).

6. Diethylene Glycol (DEG)

The DEG (diethylene glycol) content of the polymer is determined by hydrolyzing the polymer with an aqueous solution of ammonium hydroxide in a sealed reaction vessel at 220±5°C. for approximately two hours. The liquid portion of the

The DEG (diethylene glycol) content of the polymer is determined by hydrolyzing the polymer with an aqueous solution of ammonium hydroxide in a sealed reaction vessel at 220±5°C. for approximately two hours. The liquid portion of the hydrolyzed product is then analyzed by gas chromatography. The gas chromatography apparatus is a FID Detector (3100, 3100A) from Hewlett Packard. The ammonium hydroxide is 2.8 to 30% by weight ammonium hydroxide from Fisher Scientific and is reagent grade.

7. Isophthalic and Naphthalene Dicarboxylic Acid

The percent isophthalic acid and naphthalene dicarboxylic acid present in the amorphous polymer was determined at 285 nanometers using a Hewlett Packard Liquid Chromatograph (HPLC) with an ultraviolet detector. An amorphous polymer sample was hydrolyzed in diluted sulfuric acid (10 ml acid in 1 liter deionized water) in a stainless steel bomb at 230°C. for 3 hours. After cooling, an aqueous solution from the bomb was mixed with three volumes of methanol (HPLC grade) and an internal standard solution. The mixed solution was introduced into the HPLC for analysis.

8. Metal Content

The metal content of the ground polymer samples was measured with an Atom Scan 16 ICP Emission Spectrograph. The sample was dissolved by heating in ethanamine, and on cooling, distilled water was added to crystallize out the terephthalic acid. The solution was centrifuged, and the supernatant liquid analyzed. Comparison of atomic emissions from the samples under analysis with those of solutions of known metal ion concentrations was used to determine the experimental values of metals retained in the polymer samples.

9. Preform and Bottle Process

After solid state polymerization, the resin of the present invention is typically, dried for 4-6 hours at 170-180°C., melted and extruded into preforms. Each preform for a 0.59 liter soft drink bottle, for example, employs about 24 grams of the resin. The preform is then heated to about 100-120°C. and blown-molded into a 0.59 liter contour diameter giving a stretch ratio of twelve (2x6). Since the bottle size is fixed, different preform sizes can be used for obtaining different stretch ratios.

10. Scanning Electron Micrograph

Films were prepared by compression molding by heating at 275°C. in a press for 3 minutes without pressure, then the

pressure was cycled several times between 0 and 300 psi and then held at 300 psi for 4 minutes. The film was quenched in ice water. These films were notched with a razor blade on the film surface to facilitate a brittle failure, immersed in liquid nitrogen for 15 minutes, removed and fractured by hand perpendicular to the thickness direction. Fracture surfaces were coated with 100 angstrom of gold and were observed using a JEOL 840A scanning electron microscope.

The following examples are given to illustrate the present invention, and it shall be understood that these examples are for the purposes of illustration and are not intended to limit the scope of the invention.

EXAMPLES

15 Various polyester (PET) resins reflecting typical commercial recipes were produced. Comonomers included isophthalic acid (or its dimethyl ester) (IPA) and diethylene glycol (DEG) as crystallization retardants and naphthalene dicarboxylic acid (or its dimethyl ester) (NDC) to improve the temperature at which a container can be filled.

20 Amorphous polyester was first produced with an IV of about 0.5, this was then solid phase polymerized to the final resin IV. The additives used were, manganese acetate, zinc acetate, cobalt acetate, antimony trioxide and poly-phosphoric acid. The analyses of these resins are set forth in Table 1.

TABLE 1

	Resin Identification			
	A	B	C	D
Process	TA	DMT	DMT	DMT
IV	0.83	0.82	0.84	0.81
IPA, wt-%	2.5	3.1	0	0
NDC, wt-%	0	0	5	5
DEG, wt-%	1.5	0.7	0.5	0.6
Cobalt, ppm	30	40	100	0

40 A series of copolymers were made containing various amounts of 5-sulfoisophthalic acid (SIPA), either the ester or the glycolate of SIPA was used. The melt phase polymerization was conducted in the normal way, but the amorphous resin was not solid state polymerized for resin S3. In the case of Resin S1, zinc acetate was used in place of manganese acetate as the ester-interchange catalyst. The analyses of these resins are set forth in Table 2.

TABLE 2

	Resin Identification		
	S1	S2	S3
Process	DMT	DMT	DMT
IV	0.84	0.82	0.56
SIPA, mol-%	0.11	1.3	1.7
Cobalt, ppm	0	0	40

50 A master batch of the cobalt salt to be used as the transition metal catalyst for active oxygen scavenging was made by late addition of 2 wt-% cobalt octoate to a polyester prepared using 75 ppm Zn (as zinc acetate), 250 ppm Sb (as antimony trioxide), 60 ppm P (as poly-phosphoric acid) and 2.5 wt-% IPA. This material had an IV of 0.35-0.40.

55 60 ppm P (as poly-phosphoric acid) and 2.5 wt-% IPA. This material had an IV of 0.35-0.40.

65 Unless otherwise stated the partially aromatic nylon used in the blend was Type 6007 from Mitsubishi Gas Chemical,

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Tokyo Japan. Type 6007 has a number average molecular weight of 25, 900 and its melt viscosity at 271°C. and 1000 sec⁻¹ is 280 Pa-s.

Unless otherwise stated the preforms were prepared on an Arburg injection molding machine using 24 g of material, and blown into a 0.59 liter contour bottle on a Sidel SBO2 stretch blow molding machine. The bottle sidewall thickness is about 0.25 mm.

Example 1

The effect of the interaction of SIPA with Co on the yellowness of preforms and bottles was studied by blending either polyester resin D or S1 with the cobalt master batch and MXD6. The yellowness value (b*) of the preforms and bottle sidewalls are set forth in Table 3 (lower or negative b* values correspond to less yellowness).

TABLE 3

Run No.	Resin	Co, ppm	MXD6, wt-%	SIPA, mol-%	Preform b*	Bottle b*	Delta ¹	Delta ²
1	D	0	0	0	11	Control	3.6	Control
2	D	0	5	0	19.3	8.3	7.1	3.5
3	D	100	0	0	0.7	-10.3	1	-2.5
4	D	200	5	0	4.2	-6.8	3.5	-0.1
5	S1	0	0	0.11	16.3	Control	4.6	Control
6	S1	0	5	0.11	17.5	1.2	5.5	0.9
7	S1	100	0	0.11	-0.8	-17.1	1.1	-3.5
8	S1	200	5	0.11	-6.6	-22.9	2	-2.5

¹Difference in b* of the preform compared to the control.

²Difference in b* of the bottle compared to the control.

0.11 mol-% SIPA, there is a synergistic effect and the Co salt is markedly more effective in offsetting the yellowness.

Example 2

A similar trial was conducted using resin C as the control and the results set forth in Table 4.

TABLE 4

Run No.	Resin	Co, ppm	MXD6, wt-%	SIPA, mol-%	Preform b*	Bottle b*
9	C	100	0	0	-0.1	1.2
10	C	200	5	0	3.6	5.7
11	S1	200	5	0.11	-3.5	3.6

The haze of these preforms and bottle sidewalls are set forth in Table 5.

TABLE 5

Run No.	Resin	Co, ppm	MXD6, wt-%	SIPA, mol-%	Preform haze, %	Bottle haze, %
9	C	100	0	0	9.5	1.3
10	C	200	5	0	16.4	13.9
11	S1	200	5	0.11	14.3	8.2

The results again show the synergistic effect of the ionic compatibilizer on the cobalt salt as a means to reduce yellowness, in addition the ionic compatibilizer reduced the haze of the bottle sidewall containing 5 wt-% MXD6.

Example 3

Another trial was conducted in which the amount of MXD6 was varied at a constant SIPA level of 0.11 mol-%, and the results set forth in Table 6

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TABLE 6

Run No.	Co, ppm	MXD6, wt-%	SIPA, mol-%	Preform b*	Bottle b*	
5	12	C	100	0	0.4	0.8
13	S1	100	0	0.11	-1.8	
14	C	200	3	0	2.4	
15	S1	200	3	0.11	-7.4	
16	C	200	4	0	2.8	
17	S1	200	4	0.11	-7.8	
18	C	200	5	0	3.2	
19	S1	200	5	0.11	-6.1	

At all levels of MXD6 the incorporation of an ionic compatibilizer reduced the yellowness.

15 The oxygen permeability of the bottle sidewalls was measured and the results plotted in FIG. 1. This shows that the ionic compatibilizer decreases the permeability at each MXD6 concentration. Surprisingly there is a non-linear relationship of oxygen permeability with MXD6 concentration with extremely low values at 5 wt-% MXD6.

Example 4

25 In order to better define the oxygen permeability as a function of MXD6 concentration a series of blends were prepared using polyester A as the base resin. The concentration of MXD6 used was 1, 2, 3, 4, 4.5 and 5 wt-%, each containing 100 ppm cobalt octoate. The oxygen permeability of the 30 bottle sidewalls was measured and the results shown in FIG. 2.

This illustrates that there is a surprising reduction in oxygen permeability between 4.5 and 5 wt-% MXD6.

Example 5

35 Another trial was run in which the level of MXD6 was held constant at 5 wt-% and the concentration of SIPA changed, the results are set forth in Table 7. In these runs the base polyester resin was A and the master batch of SIPA polymer S2 was used.

TABLE 7

Run No.	Resins	Co, ppm	MXD6, wt-%	SIPA, mol-%	Preform b*	Bottle b*
20	A	30	0	0	3.8	1.0
21	A	130	5	0	0.5	4.1
22	A/S2	130	5	0.13	-2.5	3.6
23	A/S2	130	5	0.26	-2.9	3.7
24	A/S2	130	5	0.65	-3.6	3.3
25	S2	100	5	1.3	-9.1	2.8

These results show that the ionic compatibilizer can be used as a master batch to obtain the synergistic reduction of 55 yellowness with cobalt, as well as a copolymer that was used in the previous Examples 1-3.

Example 6

60 Instead of using sodium as the SIPA salt, a copolyester using the divalent zinc ester was made using the process that was used for copolymer S1. Since this Zn copolyester was more yellow than S1 no comparison of the relative difference between Na-SIPA and Zn-SIPA can be given. However the haze of bottle sidewalls made with PEI resin A as the control, using 0.11 mol-% SIPA (the runs containing MXD6 contained 100 ppm Co) are compared in Table 8 below.

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TABLE 8

Run No.	MXD6, wt-%	SIPA type	Haze, %
26	0	none	5.5
27	5	none	14.2
28	5	Ns	12.0
29	5	Zn	9.6

It would appear that the divalent ionic compatibilizer is more effective than the monovalent in reducing the bottle sidewall haze.

Example 7

A low molecular weight MXD6 was prepared. A mixture of 438 g of adipic acid, 428.4 g of m-xylenediamine and 500 g of deionized water were charged in a 2-liter autoclave under nitrogen atmosphere. The mixture was stirred for 15 minutes then heated to reflux for 30 minutes. Water was distilled off and the temperature was increased to 275° C. over a period of 60-90 minutes. The mixture was stirred at 275° C. for 30 minutes before extrusion. This polymer had a viscosity of 9.5 Pvs at 1000 sec⁻¹ and 271° C. (compared to 280 Pvs for the commercial 6007).

The procedure of Example 3 was followed, using this low molecular weight MXD6 (LMW) compared to the commercial 6007. The results are set forth in Table 9.

TABLE 9

Run No.	Co, ppm	MXD6, type	MXD6, wt-%	SIPA, mol-%	Preform b*	Bottle b*
32	C	200	6007	3	0	2.0
33	C	200	LMW	3	0	3.4
34	C	200	6007	5	0	4.2
35	C	200	LMW	5	0	1.1
36	S1	200	6007	5	0.11	-6.1
37	S1	200	LMW	5	0.11	-5.6

This illustrates that the color is better (less yellow) with the low molecular weight MXD6 than 6007.

The haze of these runs was also measured and the results set forth in Table 10 below.

TABLE 10

Run No.	Co, ppm	MXD6, Type	MXD6, wt-%	SIPA, mol-%	Preform Haze, %	Bottle Haze, %
32	C	200	6007	3	0	50.3
33	C	200	LMW	3	0	48.3
34	C	200	6007	5	0	50.1
35	C	200	LMW	5	0	49.9
36	S1	200	6007	5	0.11	49.3
37	S1	200	LMW	5	0.11	45.4

The use of the lower molecular MXD6 in conjunction with SIPA markedly reduces the haze of the bottle sidewalls.

Example 7

In order to determine the effect of the ionic compatibilizer on MXD6 domain size, a series of films were prepared and fractured. PET resin B was used together with blends with the S3 SIPA copolyester and 6007 MXD6. The domain size was measured and the results set forth in Table 11.

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TABLE 11

Run No.	MXD6, wt-%	SIPA, mol-%	Domain size, μm
5	10	0	0.8-1.5
	20	0	2.2-4.5
	20	1.35	0.2-0.5
	30	0.03	0.5-1.5
	30	0.08	0.5-1.5
	30	0.16	0.2-0.5

10 This shows that at a low level of SIPA, less than 0.2 mol-%, the domain size of a blend containing 10 wt-% MXD6 is reduced to less than 0.5 μm .

Example 8

15 A series of bottles were produced using C as the base PET resin, the S3 SIPA copolyester and 6007 MXD6. The passive oxygen permeability, at 0% Relative Humidity, of the bottle sidewalls was measured and the results set forth in Table 12.

TABLE 12

Run No.	MXD6, wt-%	SIPA, mol-%	O ₂ Permeability (cc(STP) · cm)/(m ² · atm · day)
38	0	0	0.180
39	2.5	0	0.181
40	2.5	0.3	0.164
41	5	0	0.138
42	5	0.3	0.131
43	5	0.6	0.145
44	10	0	0.079
45	10	0.3	0.054
46	10	0.6	0.051

35 This shows that the ionic compatibilizer is improving the oxygen gas barrier at a given MXD6 level, possibly due to the reduction in domain size, which increases the number of domains, as shown in Example 7.

Example 9

40 Following the procedure of Example 7 a polyamide was produced in which 12% of the adipic acid was replaced with isophthalic acid. The melt viscosity of this polyamide at 171° C. and 1000 sec⁻¹ was 237 Pvs. This polyamide was blended at a 5 wt-% level with PET resin C and ionic compatibilizer S3 to give a level of SIPA of 0.6 mol-% in the blend. Bottles were prepared from this blend and the oxygen permeation rate measures at 0.155 (cc(STP) · cm)/(m² · atm · day). This can be compared with a lower oxygen permeation rate of 0.145 measured on run 43 achieved with 5 wt-% MXD6.

Example 10

45 The carbon dioxide transmission rate of 0.5 liter bottles made from PET resin A were measured to be 8.6 cc/bottle/day. The addition of 5 wt-% MXD6 decreased this rate to 4.5 cc/bottle/day.

Example 11

50 Master batches using cobalt stearate and cobalt naphthenate in place of cobalt octoate were prepared using the same method as described above for cobalt octoate. Using PET base resin D, bottles were prepared using different amounts of MXD6 and different concentrations of cobalt octoate, cobalt stearate and cobalt naphthenate. The bottle wall oxygen per-

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meability was measured and the value after 100 hours (at this time the rate is at equilibrium, see FIG. 1) is set forth in Table 13.

TABLE 13

Run No.	MXD6, wt-%	Cobalt salt	Co, ppm	Oxygen Permeability @ 100 hours, (cc(STP) · cm)/ (m ² · atm · day)
47	0	—	—	0.150
48	1.75	Octoate	200	0.098
49	1.75	Octoate	400	0.120
50	1.75	Stearate	100	0.098
51	1.75	Stearate	200	0.122
52	3.0	Octoate	400	0.120
53	3.0	Octoate	60	0.048
54	5.0	Octoate	100	0.005
55	5.0	Stearate	30	0.005
56	5.0	Stearate	50	<0.005
57	5.0	Naphthenate	50	<0.005

An excess of the transition metal catalyst can in fact act as an anti-oxidant and increase the oxygen permeability, compare runs 48 and 49, runs 52 and 53.

Although particular embodiments of the invention have been described in detail, it will be understood that the invention is not limited correspondingly in scope, but include all changes and modifications coming within the spirit and terms of the claims appended hereto.

What is claimed is:

1. A composition for containers comprising:
a copolyester comprising a metal sulfonate salt;
a partially aromatic polyamide;
and a cobalt salt.
2. The composition of claim 1, wherein said partially aromatic polyamide is present in a range from about 1 to about 10 wt. % of said composition.
3. The composition of claim 2, wherein said metal sulfonate salt is present in a range from about 0.1 to about 2.0 mole % of said composition.
4. The composition of claim 1, wherein said cobalt salt is present in a range from about 20 to about 500 ppm of said composition.

5. The composition of claim 1, wherein said partially aromatic polyamide is meta-xylylene adipamide.

6. The composition of claim 1, wherein said partially aromatic polyamides is selected from the group consisting of poly(hexamethylene isophthalamide), poly(hexamethylene adipamide-co-isophthalamide), poly(hexamethylene adipamide-co-terephthalamide), poly(hexamethylene isophthalamide-co-terephthalamide), and mixtures of two or more of these.

10 7. The composition of claim 1, wherein said cobalt salt is selected from the group consisting of cobalt acetate, cobalt carbonate, cobalt chloride, cobalt hydroxide, cobalt naphthenate, cobalt oleate, cobalt linoleate, cobalt octoate, cobalt stearate, cobalt nitrate, cobalt phosphate, cobalt sulfate, cobalt (ethylene glycolate), and mixtures of two or more of these.

8. The composition of claim 1, wherein the metal ion of the metal sulfonate salt is selected from the group consisting of Na⁺, Li⁺, K⁺, Zn⁺⁺, Mn⁺⁺, and Ca⁺⁺.

20 9. The composition of claim 8, wherein said metal sulfonate salt is attached to an aromatic acid nucleus selected from the group consisting of sulfophthalic acid, sulfoterephthalic acid, sulfoisophthalic acid, 4-sulfcnaphthalene-2,7-dicarboxylic acid, and esters of each.

10 10. The composition of claim 1, wherein said metal sulfonate salt is 5-sodiumsulfoisophthalic acid, 5-zincsulfoisophthalic acid, or dialkyl esters thereof.

11. The composition of claim 10, wherein the dialkyl ester is a dimethyl ester (SIM) or a glycol ester (SPEG).

30 12. An article comprising the composition of any one of claims 1-11, wherein said article is a preform or a container.

13. The article of claim 12, wherein the article is a container having an oxygen permeation rate of <0.01 cc(STP)-cm²·atm·day after 100 hours in oxygen.

35 14. The container of claim 13, having a yellowness value (b*) of less than 2.5.

15. The article of claim 12, wherein the article is a container that has a carbon dioxide transmission rate of less than 7 cc/bottle/day, based on a 0.59 liter bottle.

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**United States Court of Appeals
for the Federal Circuit**

Invista North America S.A.R.L, et al. v M&G USA Corp., et al., 2014-1432

CERTIFICATE OF SERVICE

I, John C. Kruesi, Jr., being duly sworn according to law and being over the age of 18, upon my oath depose and say that:

Counsel Press was retained by PILLSBURY WINTHROP SHAW PITTMAN LLP, attorneys for Appellants to print this document. I am an employee of Counsel Press.

On the **13th Day of May, 2014**, counsel for Appellants has authorized me to electronically file the foregoing **BRIEF FOR DEFENDANTS-APPELLANTS M&G USA CORPORATION AND M&G POLYMERS USA, LLC (confidential and non-confidential versions)** with the Clerk of Court using the CM/ECF System, which will serve via e-mail notice of such filing to all counsel registered as CM/ECF users, including any of the following:

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Pursuant to an agreement between the parties, the confidential brief will also be served via email to the above counsel on this date. Additionally, two paper copies will be mailed to the above counsel on the time paper copies are sent to the Court.

Upon acceptance by the Court of the e-filed document, six confidential paper copies will be filed with the Court, via Federal Express, within the time provided in the Court's rules.

May 13, 2014

/s/ John C. Kruesi, Jr.
John C. Kruesi, Jr.
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